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(30)Priority

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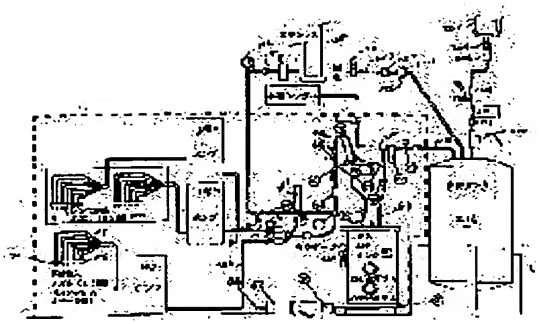
(54) DEVICE FOR DEGASSING DEIONIZED WATER FOR INSPECTION AND PACKAGING AND METHOD THEREFOR



(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a device for degassing deionized water in order to inspect and package contact lenses by passing the deionized water through plural gas permeable tubes in a vacuum chamber, measuring off the specific volume of the deionized water subjected to the degassing by precision measuring pumps and delivering the water to respective distribution points, thereby facilitating the inspection of the lenses.

SOLUTION: The deionized water is supplied to the inlet of a degassing tank 122. The deionized water in the degassing tank 122 is branched to the plural tubes arranged at a manifold and are joined again at a discharge port 126. The degassing tank 122 is operated under a low pressure (4 to 25Torr) by driving a vacuum pump 128. This vacuum pump 128 is connected to the degassing tank 122 via a pipe 130 and discharges the excess air through a pipe 132. The deionized water is discharged outside from the degassing tank 122 through a discharge pipe 126. The precision injecting pumps 140a to 140c measure off the volume smaller than 1ml of the deionized water and feeds the water to the respective distribution points.

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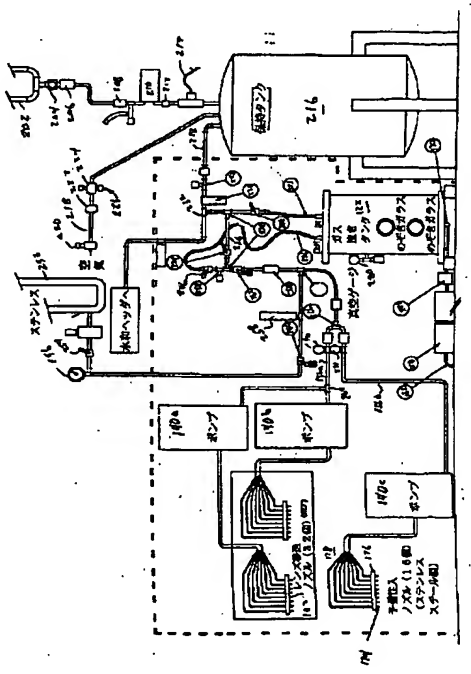
最終頁に続く

(54)【発明の名称】　検査および包装のため脱イオン水をガス抜きする装置および方法

(57)【要約】

【課題】　コンタクトレンズを検査・包装用に取扱い、準備する自動装置を提供すること。

【解決手段】　本発明によれば、コンタクトレンズを検査・包装する際に脱イオン水をガス抜きする装置であって、（ａ）真空チャンバと、（ｂ）前記真空チャンバの内部に取り付けられ、ガス抜き処理する脱イオン水を連続的に受け入れる複数のガス透過性チューブと、（ｃ）前記脱イオン水を前記複数のガス透過性チューブを通して送るための圧力差を生起させる手段と、（ｄ）前記ガス抜きした脱イオン水を複数の分配ポイントに分配するマニホールドと、（ｅ）ガス抜きした脱イオン水の１ｍｌより少ない量を測りとって前記各分配ポイントへ送り出す精密計測ポンプを少なくとも１個備える装置が提供される。



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【特許請求の範囲】

【請求項１】　複数のソフトコンタクトレンズを第１の処理ステーションから第２の処理ステーションに移動するロボット装置であって、

（ａ）複数の第１のコンタクトレンズキャリアを配備した第１のフレームであって、前記キャリアはそれぞれ凹形のレンズ保持面と移送するコンタクトレンズを保持し、前記凹形レンズ保持面は、この保持面とレンズの間に流体を導入する第１の流体手段を区画する第１のフレームと、

（ｂ）前記レンズを前記第１の処理ステーションから第２の処理ステーションへ移送するのを容易にするロボット移送ヘッドであって、（ｉ）複数のコンタクトレンズキャリアであって、それぞれのキャリアが、コンタクトレンズを収めるための凸形のレンズ取付け面と、このレンズ取付け面と前記コンタクトレンズ表面の間に流体を導入するための第２の流体手段を区画するコンタクトレンズキャリアと、（ii）前記移送ヘッドを前記第１の処理ステーションから第２の処理ステーションへ移動させるロボット移送手段を備える連接ロボット移送ヘッドと、

（ｃ）ガス抜きした脱イオン水を前記第２の流体手段へ供給する流体供給手段と

（ｄ）移送されてくるコンタクトレンズを受け取る複数の第３のコンタクトレンズキャリアを載せた第２のフレームと、

（ｅ）前記ロボット移送手段と第１の流体供給手段を作動して前記レンズを前記第１のキャリアから前記第２のキャリアへ移送するコントローラを具備するロボット装置。

【請求項２】　成形したコンタクトレンズを自動生産ラインで検査・包装する方法であって、（ａ）脱イオン水をガス抜きする工程と、（ｂ）前記のガス抜きした、少量の界面活性剤を含む脱イオン水でパッケージキャリアを一部充填する工程と、（ｃ）検査の後、前記脱イオン水を前記パッケージキャリアから自動的に取り除き、ついで前記パッケージキャリアを緩衝用生理食塩水で一部充填する工程と、（ｄ）前記レンズと緩衝用生理食塩水を、ユーザに提供するため前記パッケージキャリアに密封する工程を含む方法。

【請求項３】　コンタクトレンズを検査・包装する際に脱イオン水をガス抜きする装置であって、（ａ）真空チャンバと、（ｂ）前記真空チャンバの内部に取り付けられ、ガス抜き処理する脱イオン水を連続的に受け入れる複数のガス透過性チューブと、（ｃ）前記脱イオン水を前記複数のガス透過性チューブを通して送るための圧力差を生起させる手段と、（ｄ）前記ガス抜きした脱イオン水を複数の分配ポイントに分配するマニホールドと、（ｅ）ガス抜きした脱イオン水の１mlより少ない量を測りとって前記各分配ポイントへ送り出す精密計測ポンプを少なくとも１個備える装置。

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【発明の詳細な説明】

【０００１】本発明は、米国特許出願第258,557 号（１９９４年６月１０日出願）および米国特許出願第432,957 号（１９９５年５月１日出願）（どちらも発明の名称は「コンタクトレンズを検査および包装用に準備する自動装置および方法」）の一部継続出願である。

【０００２】

【発明の属する技術分野】本発明は、眼科用レンズの製造、特に成形済みの親水性コンタクトレンズに係り、より詳しくは、コンタクトレンズを検査・包装するために脱イオン水をガス抜きする装置および方法に関する。

【０００３】

【従来の技術】親水性コンタクトレンズの成形については、米国特許第4,495,313 号（Larsen）同第4,640,489 号（Larsen他）、同第4,460,336 号（Larsen他）、同第4,889,664 号（Larsen他）、および同第5,039,459 号（Larsen他）に記載がある（すべて本出願人に譲渡済み）。

【０００４】

【発明が解決しようとする課題】これらの従来技術文献は、２個×４個の成形用アレー（配列）に並べた前面（下方）曲線用型片と後面（上方）曲線用成型片の間に、コンタクトレンズをモノマーあるいはモノマー混合物をサンドイッチ状にして形成するコンタクトレンズの製造プロセスを開示したものである。モノマーは重合によってレンズに成形され、このレンズは型片から取り外してさらに水和浴で処理し、最終的な使用のために包装される。

【０００５】米国特許第5,080,839 号および同第5,094,609 号はそれぞれ、前述の各特許に開示されたモノマーおよびモノマー混合物から形成されたコンタクトレンズを水和するプロセスおよび、コンタクトレンズを水和するチャンバを開示している。これらの特許に開示されたプロセスは、脱イオン水と少量の界面活性剤（塩類は使わない）でレンズを水和し、型片から取り外すのに要する歩留り時間を大幅に削減するため、水和プロセスでレンズブランクの元になるポリマーに時間のかかる中和を施す必要はなくなる。脱イオン水を使用するときには、プロセスの最終工程において、緩衝用の生理食塩水を最終的なパッケージに導入し、ついでレンズをパッケージの中に密封する。これは、パッケージの中でレンズの最終的な平衡（中和、最終的な水和およびレンズの最終寸法の意味において）が、室温中あるいは殺菌工程中で達成されるようにするためである。

【０００６】米国特許第4,961,820 号（これも本出願人に譲渡済み）は、コンタクトレンズ用の最終的なパッケージを開示しているが、このパッケージは、透明なポリプロピレンブリスター（ふくれ）とこれにヒートシールされる箔のラミネートから形成される。

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【０００７】

【発明が解決しようとする課題】ところで、米国特許第5,080,839 号および同第5,094,609 号は、水和プロセスの全体と最終包装への移行を完全に自動化することを企図しており、他方上述の各特許に記載されているチャンバとプロセスは水和中にレンズを自動的に取扱うことを可能にするが、完全に自動化された装置において、レンズの高生産性を実現するために、レンズを検査のために準備しレンズを高い生産速度で処理するのに適した自動化された装備は、これまでのところは知られていない。

【０００８】

【課題を解決するための手段】上述の各特許に係る方法によるコンタクトレンズの検査における新たな展開から、本出願人の米国特許出願第994,564 号（発明の名称：「レンズ検査方法および装置」）に記載したような自動レンズ検査が生まれた。さらに、湿潤したコンタクトレンズの水和と自動取扱いにおける最近の進歩からは、本出願人に係る米国特許出願第258,556 号（発明の名称：「ソフトコンタクトレンズを水和させる自動装置および方法」）にあるような、自動レンズ検査システムによる検査に先立って水和中にロボットでレンズを自動取扱いする方法も生まれた。

【０００９】そこで、本発明の目的は、コンタクトレンズを検査用に取扱い、準備する自動装置を提供することである。本発明はさらに、コンタクトレンズを検査と包装にかけるために取扱い、準備する自動装置（ここでレンズは先に述べたのと同様に検査され、包装される）を提供することも目的とする。

【００１０】さらに、自動検査手段におけるレンズの検査を容易にするため、ガス抜きした脱イオン水とともにキャリアの間で、レンズを移動させることも本発明の目的である。そして、自動レンズ検査システムにおける検査に先立って、レンズの表面に発生する気泡を除去する装置を提供することも本発明の目的である。

【００１１】その他、ガス抜きした脱イオン水中でレンズを検査することにより、自動レンズ検査の際に誤った否定的なデータを与えるおそれのある気泡の形成を最小限に抑える、成形済みコンタクトレンズの改善した検査方法を提供することも本発明の目的である。

【００１２】また、レンズをまず使い捨てのコンタクトレンズ用型フレーム中で成形し、ガス抜きした脱イオン水中で水和・検査し、そして生理食塩水中に包装してこの最終的な包装の中で重合により形成したレンズの時間のかかる中和を行う、ソフトコンタクトレンズの改善した製造方法を提供することも本発明の目的である。そして、上述の各方法に、欠陥レンズを包装に先立って、検査済レンズのラインから取り外す統合システムを付加することも本発明の目的である。

【００１３】本発明のもう一つの目的は、ガス抜きした脱イオン水中でコンタクトレンズを検査する方法、および検査の後脱イオン水を自動的に除去する方法を提供することである。

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【００１４】最後に、本発明は、自動レンズ検査の際に誤った否定的なデータを与えるおそれのある気泡を吹き飛ばすステーションの付いた、コンタクトレンズを水和ステーションから検査ステーションへ移動させる装置を提供することも目的とする。

【００１５】本発明は、主として、米国特許出願第258,654 号（発明の名称：「コンタクトレンズ成形システム」）にあるような第１および第２の型片の間で成形したコンタクトレンズについて述べるが、本発明の成形システムに係る装置は、ヒドロゲルを乾燥状態に維持しながら、所望の光学面をもつよう切断・研磨する旋盤加工レンズの統合にも同じように適したものであることは理解されたい。さらに、本発明の装置は、液状のモノマーを遠心力にかけて所望のレンズ光学面の形状に成形するスピンキャスト法で形成するレンズの統合システムにも用いることができる。

【００１６】

【発明の実施の形態】上述の本発明に係る、検査・包装用に脱イオン水をガス抜きする装置および方法の目的・利点は、以下の添付の図面を参照して行う好ましい態様についての詳細な説明により、当業者には容易に理解されるであろう。なお、添付の図面において、各図に共通の要素には同一の参照符号を付した。

【００１７】本発明は、コンタクトレンズ自動製造装置における水和後の処理に係る部分のためのものである。米国特許出願第258,654 号（発明の名称：「水和中のコンタクトレンズを取扱うシステム」）にあるような自動製造ラインで成形され、米国特許出願第994,564 号（発明の名称：「レンズ検査方法および装置」）にあるように自動検査されたコンタクトレンズは、本発明の利点に与るところが大きい。

【００１８】（水和後プロセス）本発明は、検査中にコンタクトレンズを移送し、また検査後には最終包装の一部として働く多目的使い捨てレンズパッケージキャリアを提案するものである。

【００１９】図１に示した適当なパッケージキャリア２０は、射出成形あるいは熱形成されたポリプロピレンのようなプラスチックシート材料から製造され、一端に第１のフランジ部材をなす傾斜壁部３８、そして他端にはロボットで扱うパッケージキャリアに整列させるための嵌め込みフランジ３３ａと３３ｂ（３３ａのみが図１に示されている）の対を有するほぼ矩形の平面状ベース部材３４を含む。このパッケージキャリアは、本出願人の米国特許出願第995,607 号（発明の名称：「眼科用レンズパッケージ」）に詳しく記載されている。ベース３４の各側には、嵌め込みノッチ３１ａ，３１ｂが設けてあり、これらのノッチは、パッケージキャリアとレンズをさらなる取扱いや処理にかける処理・包装操作において

用いられる種々の支持パレットにある嵌め込みピンと共働する。パッケージに一体に形成され、コンタクトレンズ（図示せず）の曲線形状に一致するほぼ半球形の空隙３６は、パッケージの中心からずれて設けられる。コンタクトレンズは、米国特許第4,691,820 号（Martinez；本出願人に譲渡済み）と同様の方法で適当な殺菌水溶液に審査されている間、この空隙３６に密封状態で格納される。ベース部材３４から延びるフランジ３８の高さｈは、空隙３６の深さを補完するもので、後述する特別な形状のパレットキャリアにあるフランジ３３ａ，３３ｂと共働する際、パッケージキャリアの自己配列（セルフアラインメント）を可能にする。フランジ３８はまた、製品の最終包装の際にも、複数の「シェブロン（山形の袖章）」形状の隆起３２（この後出荷用にカートンに詰めるためひっくり返して重ね合わせたパッケージキャリアの空隙構造を支持する補助をする）と共働して使用される。

【００２０】空隙３６はまた、複数の照合用マーク３７を含む。このマークは、水和後の処理ステーションの一つで脱イオン水を除去する間、コンタクトレンズを空隙の中央位置に保持するのを補助する際に使用される。パッケージキャリアはまた、出荷の際にコンタクトレンズを気密状態に保つため、箔のラミネートカバーをヒートシールするのに用いられる環状フランジ３９を備える。切り抜き部３５は、ユーザがレンズを使用するためにカバーストックあるいは箔のラミネートを除去する際、フランジ３８とパッケージの把持を容易にするのに用いられる。

【００２１】ベース部材３４はまた、上側にある真空グリッパに適当な係合帯を提供する滑らかな平面３４ａを含む。この平面３４ａは、製造ラインの各段階においてパッケージキャリアを移送するのに用いられる。

【００２２】図２は、レンズ自動検査システムの中でパッケージキャリアを移送する検査キャリアを示す。検査キャリア１０は、パッケージキャリアのボウル３６を収め、またレンズ自動検査システムを目視するための通路を提供する空隙４０の第１および第２の列１０ａおよび１０ｂを含む。各側に等間隔に設けられた係合ピン４１はパッケージキャリアに係合し、端部係合ピン４１ａは、ただ一個のパッケージに係合する。これらの係合ピンは、パッケージキャリアの係合ノッチ３１ａ，３１ｂに係合し、検査キャリアの長手方向において、パッケージキャリアとの正確な係合を達成する。他方硬質の縁部４２ａ，４２ｂは、下に延び出たフランジ３３ａ，３３ｂの符合の目印となり、またピン４１とともにキャリアパッケージが回転するのを防止する。検査パレット１０の各側には、さらに、３個の係合用の穴４３が設けられる。これらの穴はパレットを自動レンズ検査ステーション内を移送したり、パッケージキャリアを装着・取り外しを行う際にパレットを所定の位置に固定するときに用

いる。検査パレットにはその他、検査パレットを自動レンズ検査システムに設置し、またこれから取り外すオーバーヘッド移送システムを把持するための溝４４ａ，４４ｂの対が設けられる。斜面４５の対は、パッケージキャリア３０にある下に延び出たフランジ３８が入り込むための隙間を与える。

【００２３】図１に示したように、ポリプロピレン製のレンズキャリア２０には、二つの目的がある。一つは、自動レンズ検査システムでレンズを検査する際のキャリアとなることで、もう一つは、エンドユーザに出荷する際のレンズの最終的な包装のための容器となることである。これらのパッケージキャリアは、所定のアレーで典型的には１成形サイクル当り４×４列で計１６個成形され、ロボット移送手段によって射出成形の型から取り外される。

【００２４】パッケージキャリアはついで、パレット装填ステーションにある検査パレット１０に載置される。好ましい態様においては、パッケージキャリアは、このようなアレーでの製造効率を最大にするため、４×４個の配列で成形されるが、検査パレットに移す際には２×８個のアレーにする。パッケージキャリアを装填した検査パレット１０は、ついでコンベアで、図１０と１１に示す脱イオン水射出ステーション１６まで搬送される。検査パレット１０とともに搬送される各パッケージキャリアは、この脱イオン水射出ステーション１６で、一部にガス抜きした脱イオン水を充填される。検査パレット１０は、この後プッシュコンベアでレンズ装填エリアまで移送される。このレンズ装填エリアでは、ガス抜きされた脱イオン水が充填された計３２個のパッケージキャリアが連なる接触装填エリアを与えるよう、第２のパレットでバッチ処理される。

【００２５】（脱イオン水のガス抜き）本発明は、米国特許出願第994,564 号にある自動レンズ検査システム用の検査媒体として少量の界面活性剤を含むガス抜き済み脱イオン水を利用する。

【００２６】パッケージキャリアボウルに脱イオン水のみを用いる場合には、コンタクトレンズとキャリア表面との間で摩擦や疎水性の吸引力が生じ、レンズを所望の位置へ移動させるのを妨げるくぼみが発生することがある。例えば、ある公知のプロセスにおいては、コンタクトレンズは、液状のヒドロゲモノマーから形成され、米国特許第4,495,313 号にあるように防砂エステルなどの不活性な希釈剤の存在下で重合される。この不活性の希釈剤は、重合の間ヒドロゲルレンズの空隙を充填し、ついで水和プロセスにおいて脱イオン水と交換される。

【００２７】ところで、水和プロセスが完了した後でも、少量の酸基はレンズの表面に残留していることがあるため、レンズをレンズキャリアのくぼみに載置したときに、これらの酸基のため、レンズがキャリアのボウル表面に付着することがある。そうすると、自由な移動が

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阻害されるため、レンズは所望の位置まで移動しないことがある。このような事態が起こったときにレンズを自動レンズ検査システムで検査すると、レンズが検査視野に入らないため拒絶されたり、不良品として誤って判断されることがある。

【００２８】米国特許出願第258,266 号（発明の名称：「光学検査の対象を中央に位置させる界面活性剤」）においては、この問題に対する解決策として、少量の界面活性剤を脱イオン水に添加することを提案している。界面活性剤は、レンズとレンズホルダとなるくぼみ表面の間の摩擦を減らし、また疎水性の吸引力が発生するのを防止して、レンズが所望の位置まで確実に引き寄せられるのを補助する。

【００２９】本発明には種々の界面活性剤を用いることができる。例えば、ポリオキシエチレン２０ソルビタンモノオレエートで、ポリソルベート（Polysorbate ）８０あるいはtween 80、tween 80k[0]などの商品名で知られている。tween 80を溶液１００万部当り２５部程度の濃度で添加すると、レンズは、付着することなくパッケージキャリア２０内を移動できるようになるが、これより高い濃度でも使用できる。例えば、溶液中の濃度が０．０１～５．０重量％でもよい。界面活性剤は、所望の溶液をつくるため、脱イオン水などの適当な液体キャリア（担体）と混合することができる。

【００３０】溶液中の界面活性剤の濃度は、上で述べた濃度範囲の下限が好ましい。例えば、脱イオン水１００万部当り５０部より低くてよい。このような低濃度で界面活性剤を使用すると、界面活性剤が泡立つのが避けられ、界面活性剤を所定の濃度以下にできる。

【００３１】水を圧縮した流体ラインから低圧（大気圧）の環境下に噴出させる際に、気泡あるいはガスの泡が生成するのを防止するには、ガス抜きした水を使うのが好ましい。ガス抜きしていない脱イオン水を用いると、小さな気泡が、レンズを移動する前にパッケージに生じたり、あるいはパッケージキャリアにコンタクトレンズを移す際にコンタクトレンズ上に生じたりする。これらの気泡は、脱イオン水に溶解しているガスから生じ、レンズの種（seed）、あるいはパッケージキャリア表面の小さなむらとなる。

【００３２】脱イオン水をガス抜きする装置は、図３～５に示す。図３は、ガス抜きモジュールの模式図であり、他方図４はガス抜きユニット１２２の詳細な長手方向断面図である。脱イオン水は、入力ライン１１２を通して脱イオン水源（水和時の供給源にもなる）から供給される。コンテナから水を引く場合は、脱イオン水タンクあるいはポンプ１１４にエアブランケットをかける。

【００３３】脱イオン水はついで、水中に含まれているおそれのある外部からの粒子状汚染物を取り除くため、フィルタ１１８を通す。

【００３４】脱イオン水は、この後、ガス抜きユニット

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１２２の入口に供給する。ガス抜きユニット１２２の中では、脱イオン水はマニホールドに配置された複数のチューブ１２４に分岐され、ガス抜きユニット１２２の排出口１２６で再度合流する。ガス抜きユニット１２２は、真空ポンプ１２８を駆動して低圧（典型的には４～２５torr）の下で作動させる。この真空ポンプ１２８は、管１３０を介してガス抜きユニット１２２に接続され、管１３２を通じて過剰の空気をガス抜きユニットから排出する。

【００３５】脱イオン水は、ガス抜き抜きユニット１２２から排出管１２６を通じて外に出ると、管１３６ａ，１３６ｂおよび精密注入ポンプ１４０を介してマニホールド１３８ａ，１３８ｂに流入する。マニホールドは、注入ステーション１６および、ロボット移行装置に取り付けたロボット移行アレー１０２において、各コンタクトレンズ用パッケージキャリアに複数のノズルを提供する共通の供給源として用いられる。ガス抜きした脱イオン水をマニホールド１３８に送り出すポンプ１４０には、ＦＭＩポンプ（ニューヨーク州オイスターベイのFluid Metering, Inc.製）を、ニューヨーク州オイスターベイのOyster Bay Pump Works, Inc. 製造のポンプ駆動装置に取り付けて用いた。これらのポンプは、ガス抜き済み脱イオン水の溶液を正確な量だけパッケージボウルに注入し、気泡の発生やレンズの付着を抑え、溶液があふれ出る（パッケージの密封領域に水が付着することになる）のを防止し、検査システムに適した水量に制御できる。

【００３６】ここで図４をみると、この図にはモノマー用のガス抜きユニット１２２が詳細に示されている。このガス抜きユニット１２２は、円筒形の側壁１４４、頂部プレート１４６および底部プレート１４８からなる圧力領域を含む。底部プレート１４８には、図５に示す用に、真空ポンプ１２８に連なる穴１３０が設けられる。

【００３７】頂部プレート１４６は、フランジ１５０とＯリング１５２（フランジと頂部プレートの間で圧縮される）を使って円筒形の側壁１４４に取り付けられる。Ｏリング１５２の圧縮と頂部プレート１４６のフランジへの取付けは、頂部プレート１４６をフランジに取り付けるボルト１５６を使って行われる。

【００３８】水の流入管１２１は頂部プレート１４６を通って延び、チャンバ１４４ａ内でＹ字形コネクタにより２本以上の、好ましくは等しい長さの管に分岐し、均等な後方圧を与えて各分岐に均一な流量を実現する。これらの管は、シリコンマニホールド１６０に接続される。ガス抜きタンクの内部には、２～１０個のシリコンマニホールド（それぞれガスを透過する１０本のチューブを有する）が配置される。本発明の好ましい態様においては、このマニホールドは６個用いる。マニホールド１６０は、二本を平行に配置したものを順に連結していく。

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【００３９】ガス抜きユニットの内部構造は、マニホールドのパイプとガス透過マニホールド１６０の両方を支持するデルリン製ブロック１６７と１６８の対に取り付けられる。ガス抜きユニットのデルリン製ブロック１６７，１６８は、頂面フランジ１４６から吊り具２８２，２８４を使って釣り下げてもよい。そして、この頂面フランジ１４６は、頂面ブロックと吊り具２８６，２８８を吊し、これらの吊り具２８６，２８８は底面ブロックを吊す。流路は上から下に向かい、第１の平行アレーから流れる水は、チューブ２９０を備えた第２のアレーに向けて頂部に戻る。そして、次はこの第２のアレーからチューブ２９２を通って次の平行アレーに進む。ガス抜きをした水は、最終的には頂部の出口に向かい、排出パイプ２４４を介して放出管１２６に進む。

【００４０】シリコン製マニホールドに滞留している間、溶解したガスは、ポンプ１２６により生成した真空によりチャンバ１３０の出口を介して引かれ、マニホールド１６０のチューブ壁を通って脱イオン水から移行する。水がチャンバの頂部に近づくころには、溶解したガスはほぼなくなっている。

【００４１】図１２と１３には、マニホールド１６０の一つを示してある。このうち図１２は、マニホールド１６０の拡大した部分図であり、図１８は図１２の１３－１３'線断面図である。図１３に示すように、各マニホールド１０は、３本－４本－３本に配列された複数のチューブ２８８を含む。各チューブ２８８は、マニホールドをデルリン製取付けブロック１６７，１６８に封止する一体封止部材２９６を含むマニホールド取付けブロック２９４ａ，２９４ｂに取り付けられる。

【００４２】マニホールド１６０の各チューブには、大量移送の効率を高めるため、スタティックミキサ１７０（図１２にそのうちの一個を示す）を設置する。これらのスタティックミキサ（イリノイ州キャリーのKoflo 社製造）は、デルリン製で、直径が１／４インチ、長さが６インチである。

【００４３】ガス透過性チューブにとって好ましい材料は、ニュージャージィ州アンドーバーのSanitech社製ＳＴＨＴチューブ（ミシガン州ミッドランドのダウコーニング社製造のQ74780医用グレードのシリコンゴムから製造する）である。

【００４４】本発明の装置は、各マニホールド１６０が１０本のチューブを含むように配置される。各チューブは、内径が１／８～１／２インチ、好ましくは１／４インチ、壁厚が１／１６～１／３２インチ、好ましくは１／３２インチで、ジュロメータ硬度は８０である。

【００４５】タンクの頂部と底部にあるヘッダーチューブは、シリコン、あるいは他の不透過性材料からもつくることができる。これらのチューブは、流れに不均衡が生じる元となる圧力差が生じないよう、どれも同じ長さにする。各ヘッダーチューブはついで、ガス抜き装置の

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出口を一つにするよう、Ｙ字形に接続される。

【００４６】図５は、本発明で用いる流水系の模式図である。この図において、脱イオン水は再循環供給管２０２から、遮断弁２０４、フィルタ２０６、流量計２０８および、脱イオン水の供給を電気的に制御する電気作動式の空気圧弁２１０を通して供給される。逆止弁２１２と手動式遮断弁２０４は、導管２０２中で脱イオン水を再循環させるため隔離を行う。供給管２１４は、先に述べたtween 80のような界面活性剤を少量計量したものを供給する。

【００４７】脱イオン水は、保持タンク２１６に格納され、かつ圧力レギュレータ２２０、空気フィルタ２２２、および急速排出口２２６を備えた電気作動式ソレノイド弁２２４を有する導管２１８を通して供給システムから供給されるエアブランケット（air blanket ）によって圧縮される。

【００４８】装置の通常の操作においては、タンク２１６内の脱イオン水は、１０～２０psi 、好ましくは１５psi に維持された空気圧のブランケットによって圧縮される。脱イオン水は、脱イオン水タンク２１６から、導管２２８とフィルタ２３０を介して第１のＴ字マニホールド２３２まで引かれ、ここで二つのプロセス流に分岐される。このプロセス流のうちの一つは、前にも述べた米国特許出願第256,556 号（発明の名称：「ソフトコンタクトレンズを水和する自動装置および方法」）にある水和装置に水を供給する。

【００４９】バイパス弁２３４と分岐導管２３６を含むバイパスシステムは、一対のＴ字導管２３８を介してシステムに接続される。通常の操作においては、バイパス弁２３４は閉止され、脱イオン水は、Ｔ字マニホールド２３８、遮断弁２４０および入口チューブ１２１を通って、本発明のガス抜きタンク１２２まで進む。ガス抜きした脱イオン水は、供給時には、ガス抜き真空タンク１２２から、出口導管２４４と弁２４６を通ってレンズ移送ノズルおよび検査パッケージに進む。

【００５０】所望の時に試料を取り出すため、試料用の穴２４８と２５０が設けられる。入口チューブ２４２と出口チューブ２４４にあるフランジ付きのコネクタ、および入口弁２４０と出口弁２４６、ならびにバイパス弁２３４を使うと、システムはガス抜き真空タンク１２２に向かう分路２３６を通って迂回し、排水時においても生産ラインの連続作動が維持される。

【００５１】蒸気再循環管２５２には、米国特許出願第432,927 号（発明の名称：「オンライン蒸気衛生設備」，本出願人に譲渡済）にあるように、分配チューブを定期的に殺菌するため、遮断弁２５４、圧力ゲージ２５６およびフィルタ２５８が設けられる。通常の操作の場合は、蒸気の供給は、ロック式の閉止弁２６０を使って、ガス抜きした脱イオン水の供給とは一緒にならないようにして行う。これら二つの弁は、分配系を隔離し、

蒸気がガス抜き真空タンクおよび脱イオン水タンクに入ることのないようにする。また、分配系の殺菌中に脱イオン水も蒸気もシステムの中に入らないよう、逆止弁２６４も設置される。

【００５２】ガス抜きシステムの出力は、第１のＴ字形マニホールド２６６と第２のＴ字形マニホールド２６８を介して分岐され、本発明のガス抜き済脱イオン水に係る三つの主要なシステムが得られる。主要な各システムの圧力を計測するため、圧力ゲージ２７０と２７２が設けられる。精密計測ポンプ１４０ａと１４０ｂの対は、ガス抜き済脱イオン水を、図６～９に示した、レンズをあるシステムから次のシステムに移送する際に用いられるレンズ移送ノズルに送り出す。第３の精密計測ポンプ１４０ｃは、ガス抜き済脱イオン水を、図１０に示したマニホールド１７８と複数のノズル１７４に送り出す。これらのノズルは、ガス抜き済脱イオン水を、正確に測って、すでに図１において説明した複数の検査パッケージ用キャリア２０が収まったパレット１０に注入する。

【００５３】ガス抜き真空タンク１２２は、真空ゲージ２８０、真空ポート１３０、感圧スイッチ２８２、真空ポンプ１２８および、空気や絞り出された脱イオン水をドレーン系に排出する排出口１３２を備える。すでに述べたように、タンク１２２の圧力は、通常は、スイッチ切替される真空ポンプ１２８を使って４～２５torrに維持される。ガス抜き装置を通常に操作する場合は、少量の脱イオン水が、シリコンチューブ１６０のカーブを透過して絞り出され、真空ポンプ１２８は、通常の操作時には、少量の水を取扱うことのできるダイアフラムポンプである。

【００５４】（検査前の準備）本発明は、米国特許出願第258,556 号（発明の名称：「ソフトコンタクトレンズの自動水和装置および方法」，本出願人に譲渡済）に開示された発明の実施する際に特に適合する。

【００５５】図６に示すように、複数の、例えば３２個のコンタクトレンズを搭載した水和キャリア８６０は、水和装置から移送位置まで移動する。各凸レンズキャリアによっては、ただ一個のレンズが搬送される。凸レンズキャリアの４×８個のアレー１０２（組み替えもできる）を備えた連接回動するロボット移送装置は、ついで、アレーを、図６と図７（Ａ）に示す第２の水和キャリア８６０ａの上方に位置させる。

【００５６】図７（Ａ）に示すように、ただ１個のコンタクトレンズ８は、凹レンズキャリア８６１によって搬送され、４×８個のアレー１０２の上に設置された凸レンズキャリア１０４のすぐ下までもって来られる。凹レンズキャリア８６１は、流体を凹レンズキャリアの表面とレンズ８の間に導入するための少なくとも１個のポート８６２を含む。流体は、上方プレート８６７の下側を切り取ったチャネル８６６を通って供給される。このチャネル８６６は流体マニホールドと複数の流体コネクタ

８６３をつなぐもので、また流体コネクタ８６３は、図６に最もよく示されている凹レンズキャリア８６１の表面上方まで延びる。流体コネクタ８６３は、４×８個のアレー１０２の上側に形成される流体カップリング８６４に係合するような形状にする。これらのカップリングはそれぞれ、コンタクトレンズ８を凹レンズ保持手段８６１から凸形レンズ保持手段１０４まで移送するのに用いる移送用の流体を供給する流体用導管８７４に接続される。

【００５７】コンタクトレンズを水和キャリア８６０からロボットアレー１０２に移送する、図６に示す態様においては、流体の移送は、空気圧によるのが好ましい。したがって導管８７４は、圧縮空気をカップリング８６４に送り、今度はカップリング部材８６４が、圧縮空気を流体カップリング８６３、チャネル通路８６６、およびポート８６２に送る。

【００５８】図７（Ａ）に示すように、コンタクトレンズ８は、水和ステーションにおいて水和した後水を落されたばかりで依然として湿っている。さらに、レンズは、レンズ保持手段８６１の凹面内でレンズを中央に寄せることによって湿ったコンタクトレンズを取扱いやすくするために少量の界面活性剤を含む脱イオン水で水和されている。このため、空気圧縮ライン８７４を作動させると、ポート８６２を通じて空気による押し出しが起こり、コンタクトレンズは凹形レンズキャリアの表面から上方に引き揚げられ、凸形レンズキャリア１０４に係合する。レンズが界面活性剤とともに、あるいはこれなしで凸形レンズキャリア１０４に付着している間、界面活性剤は、凸形レンズキャリア１０４の表面を濡らし、脱イオン水の表面張力と周囲の大気圧によって、この表面への付着力を増大させる。移送の際には、直接的で正確な移送を確保するため、各凸形レンズキャリア１０４は、１．５㎜のレンズの中に位置させるのが好ましい。

【００５９】レンズ８を凸形レンズキャリア１０４に移送した後は、ロボット移送装置はレンズのアレーを、マニホールド８６０に似た、複数のカップ部材１０４（このうちの１個を図７（Ｂ）に示した）を有するマニホールドを装備する「気泡吹き飛ばし」ステーションに移動させる。各カップ部材は、第２の凸形レンズキャリア１０４の凸面にほぼ同じ形状の凹面１０８を含む。このカップ部材の凹面には、このような凹面１０８が好ましいことは分っているが、単一のジェット装置でも同じような機能が得られる。凹面１０８はまた、圧縮流体をカップ部材に形成された中央通路を通して取り入れるための少なくとも１個のポート１１０を含む。脱イオン水に少量の界面活性剤を含ませると、レンズが第１のキャリアから第２のキャリアへ移動しやすくなるが、他面、コンタクトレンズ８を覆う脱イオン水の層に小さな気泡１０５の発生を引き起こす。レンズを噴出する圧縮流体に曝すと、小さな気泡１０５は、レンズを検査キャリアに移

送する前に、外側に移行し、消滅する。自動レンズ検査システムで誤った否定的なデータがとられるのを防止するためには、このような気泡を取り除くのが好ましい。本発明の好ましい態様においては圧縮空気を使用したが、脱イオン水も使用することができる。

【００６０】（パッケージキャリアへの注入）図３と５について説明したように、脱イオン水は、ガス抜きユニット１２２でガス抜きされ、また複数の精密注入ポンプ１４０によって脱イオン水注入ステーション（図１０と１１に詳しく示してある）に分配される。図１１に示すように、ベルトの対を備えたゴム製ベルトコンベア１２ａは、検査キャリア１０をパッケージキャリア装填エリア１１（図３に示した）から脱イオン水注入ステーション１６まで搬送する。一連の検査キャリア１０を注入ステーション１６の上流側に留めておくためには、つめ１７１を備えた空気圧しぼり１７０を用いる。新しい検査キャリア１０を装填するときは、空気圧しぼり機構１７０がつめ１７１を引き込み、検査キャリア１０が、コンベア１２ａ上の注入ステーションに搬送されるようにする。もう一つの空気圧ロック機構に取り付けた離隔した顎の組は、同様の方法で検査パレット１０に係合し、これをパッケージ注入位置にしっかりと保持する。複数の注入ノズル１７４は、水平往復ビーム支持部材１７６に取り付けられ、複数のチューブ部材１７８を介してＦＭＩ精密注入ポンプ１４０に接続する。このとき各ポンプはそれぞれのノズルに接続する。各ノズル１７４は、内径が０．０４５～０．０４８インチの１６個のゲージテフロン針で終端し、パッケージキャリア２０のすぐ上、より詳しくはボウル部材３６の上方に釣り下げられる。操作の際には、支持フレーム１８１と１８２にしっかりと固定された空気圧シリンダ１８０が、搬送部材１８４、垂直サポート１８５，１８６および水平取付けビーム１７６を往復させ、テフロン針の先端をパッケージキャリア２０のくぼんだボウル３６より下方に位置させる。テフロン針の先端は下方に向けて往復し、この針を通して、約６００mlのガス抜き済み脱イオン水がボウル３６を一部充填するために注入される。ボウル３６に所定の脱イオン水が注入されると、空気圧シリンダ１８０が作動し、往復支持ビーム１７６が、パッケージキャリア２０からテフロン針を持ち上げるために、引き上げられる。往復運動をする注入針を使うと、ガス抜き済み脱イオン水を注入する際に撹拌する必要がなくなる。不適当な撹拌をすると、空気が取り込まれ、気泡の発生（誤った否定的な検査結果の元になる）につながる。検査キャリア１０は、ついで、注入ステーション１６を出て、コンベア１２ａの端に向かう。そしてここで、検査キャリア１０をステンレススチールのプラットホームを横切ってレンズ検査装填エリアまで押し込むプッシュコンベアに係合する。

【００６１】本発明に係る水和後の処理部では２×８個

および４×８個のアレーが利用されるが、本発明においては、種々の配列のアレーを用いることができることは理解できるであろう。

【００６２】図６に示す水和キャリア８６０の４×８個のアレーは、パレット１０の対によって形成されるレンズ装填エリアにあるパッケージキャリアの４×８個のアレーとは異なる。ロボット移送手段１００に取り付けられた４×８個のアレー１０２は、水和キャリア８６０においてレンズとレンズの間に３０㎜四方の寸法をもつ４×８個のアレー、および「気泡吹き飛ばし」ステーション７０を収めるように調整することができ、そうすると３０×５０㎜の寸法に拡大する。検査パレット１０の対によって形成されるレンズ装填エリア（図８および９のところで説明する）におけるこれは第３の４×８個のアレーの寸法に等しい。

【００６３】図８には拡大配置された４×８個のアレー１０２を、また図９にはこのアレーの縮小配置された模様を示す。アレー１０２は、先に図６と７について説明した３２個の凸型レンズキャリア１０４を含む。アレーの中心線に沿って、導管８６３を第２の水和キャリア８６０に係合させる４個の流体カップリング部材８６４が並ぶ。アレーは、それぞれが８個の凸形キャリア１０４を搬送する４本のライン１９０～１９３からなる。核ライン１９０～１９３は、図８で詳しく説明するように、内部案内ロッド１９４と１９５に沿って往復するように設置される。空気圧チャック１９６と１９７は、アレーの各側に設けられ、作動と同時に最も外側にあるライン１９０と１９３を、図８に示すように、案内ロッド１９４，１９５に沿って外側に引き込む。最も外側のアレー１９０と１９３はそれぞれ、内部スライドしぼりの対（そのうちの１個を図８に符号１９８で示す。これは最も内側のライン１９１と１９２を外側に引き出す役割をする）を搬送する。このとき、ライン１９０はライン１９１を、またライン１９３はライン１９２を引っ張る。圧縮ばね１９９はまた、アレーの各ラインを分かつのを補助する。

【００６４】アレー１０２は、レンズを水和ステーションからレンズ装填エリアに移送する際、アレーに適切な方位を与えるため、ターンテーブル１０３の回りで回転できることにも留意すべきである。ターンテーブル１０３は、第１および第２の連接アームに取り付けられるため、４×８個のアレーに、ロボット移送装置が与える種々の移送ポイントの間で、完全な三次元方向の動きをさせることができる。

【００６５】図７（Ａ）と図７（Ｂ）に示すように、凸形レンズキャリア１０４はまた、少なくとも１個のポート１１１で終端する内部導管１１０を含む。このポート１１１は、流体を凸形レンズキャリアとコンタクトレンズ８に間に導入するのに用いる。アレー１０２がレンズ装填エリアにおいて複数のレンズキャリア２０の上方に

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位置しているときは、アレー１９０～１９３は、各凸形レンズキャリア１０４と整列するように拡がるが、このとき関連するパッケージキャリア２０のそのすぐ下にあり、少量（通常３００μｌ）のガス抜き済み脱イオン水は、精密注入ポンプ１４０により導管１１０を通して送り出され、コンタクトレンズ８を凸形キャリア１０４からパッケージキャリア２０のボウル３６まで移送する。ここでもガス抜き済み脱イオン水を使用すると、レンズが、脱イオン水中に溶解していたガスから小さな気泡が発生するおそれなく（これはコンタクトレンズ８の上で「種」となる可能性がある）、移動できるようになる。レンズ８がパッケージキャリア２０に移送されると、４×８個のアレー１０２は、空気チャック１９６，１９７（図８）を使ってつぶし、水和キャリア８６０の形状に合うよう形に戻す。

【００６６】検査キャリア１０の対がレンズ装填エリアに装填されると、第２のサーボモータ駆動式プッシュアームが両パレットをレンズ装填エリアからオーバーヘッドダブル軸搬送キャリアまで移送する。この搬送キャリアは、検査キャリアのうちの一つを取り出し、自動レンズ検査ステーションに送るために拾い上げる。これについては、米国特許出願第258,557 号（発明の名称：「コンタクトレンズを準備するための自動装置および方法」）に詳細に記載してある。

【００６７】以上、本発明を好ましい態様に則して説明してきたが、当業者ならば、特許請求の範囲の記載から逸脱しない範囲で、本明細書で述べた態様に変更を加えることは想起し得るであろう。

【００６８】本発明の具体的な実施態様は、以下の通りである。

１）前記流体供給手段はさらに、ガス抜き済みの脱イオン水を前記第２の流体手段に供給するための真空ガス抜き装置を具備する請求項１記載のロボット装置。

２）前記真空ガス抜き装置は真空チャンバと、脱イオン水をガス抜き用に受け取る複数のガス透過性チューブ、およびこのガス透過性チューブを通じて脱イオン水を流すための圧力差を生じさせる手段を備える上記実施態様１）記載のロボット装置。

３）前記真空ガス抜き装置はさらに、前記真空チャンバ中での真空レベルを４～２５torrに維持する真空ポンプを備える上記実施態様２）記載のロボット装置。

４）前記脱イオン水をガス抜きする工程は、前記検査キャリアを一部充填する工程に先立って、真空ガス抜き装置中で行われる請求項２記載の方法。

５）前記真空ガス抜き装置は、真空チャンバと、このチャンバに取り付けられた、脱イオン水をガス抜き処理のために受け取る複数のガス透過性チューブを備え、前記ガス抜き工程は、脱イオン水を前記ガス透過性チューブを通じて送り込むための圧力差を生じさせる工程を含む上記実施態様４）記載の方法。

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【００６９】６）前記真空ガス抜き工程はさらに、前記真空チャンバ中での真空レベルを４～２５torrに維持する工程を含む上記実施態様５）記載のロボット装置。

７）前記圧力差を維持する工程は、脱イオン水を前記ガス抜き装置に供給する脱イオン水格納タンクをエアブランケットで覆うことによって達成される上記実施態様６）記載のロボット装置。

８）前記ガス透過性チューブは、ジュロメータ硬度が８０のシリコーンゴムから形成される請求項３記載の装置。

９）前記各ガス透過性チューブは、内径が１／８～１／２インチ、壁厚が１／１６～１／３２である上記実施態様８）記載の装置。

１０）前記各ガス透過性チューブの内径は１／４インチである上記実施態様９）記載の装置。

【００７０】１１）前記各ガス透過性チューブの壁厚は１／３２である上記実施態様９）記載の装置。

１２）前記各ガス透過性チューブは複数のガス抜きマニホールドアセンブリに束ねられる上記実施態様９）記載の装置。

１３）前記脱イオン水は、平行な流路を形成しながら前記マニホールドの各チューブに供給され、前記マニホールドにあってはシリアルな流路を形成する上記実施態様１２）記載の装置。

１４）前記装置はさらに、ガス抜き処理する脱イオン水を収納する格納タンクを具備する請求項３記載の装置。

１５）前記圧力差を生起させる手段は、前記格納タンク内に維持される制圧のエアブランケットである上記実施態様１４）記載の装置。

【００７１】１６）前記マニホールドは、複数のコンタクトレンズパッケージの上方に取り付けられる複数のノズルを具備する請求項３記載の装置。

１７）前記マニホールドは、前記ガス抜き済みの脱イオン水を前記コンタクトレンズパッケージに分配する際に、垂直方向に往復運動をする上記実施態様１６）記載の装置。

１８）前記ノズルは前記コンタクトレンズパッケージに垂直方向に入り込み、また前記精密測定された脱イオン水の流れは、前記各ノズルの先端が前記分配されたガス抜き済み脱イオン水に浸漬している間に終結し、前記ノズルの先端は、前記脱イオン水の流れが絶えたら、前記パッケージから垂直方向に引き上げられる上記実施態様１７）記載の装置。

１９）前記複数の分配ポイントには、複数のコンタクトレンズキャリアが含まれ、このキャリアのそれぞれは、コンタクトレンズを収める凸形のレンズ取付け面と、前記ガス抜きした脱イオン水を、前記凸形のコンタクトレンズ取付け面と凸形の面の間に導入する流体の通路を区画する請求項３記載の装置。

【００７２】

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【発明の効果】以上説明したように、本発明によれば、コンタクトレンズを検査・包装用に取扱い、準備する自動装置が提供される。また本発明によれば、ガス抜きした脱イオン水とともにキャリアの間で、レンズを移動させ、自動検査手段におけるレンズの検査を容易にすることもできる。そして、自動レンズ検査システムにおける検査に先立って、レンズの表面に発生する気泡を除去する装置も提供される。その他、ガス抜きした脱イオン水中でレンズを検査することにより、自動レンズ検査の際に誤った否定的なデータを与えるおそれのある気泡の形成を最小限に抑える、成形済みコンタクトレンズの改善した検査方法も提供される。最後に、本発明によれば、自動レンズ検査の際に誤った否定的なデータを与えるおそれのある気泡を吹き飛ばすステーションの付いた、コンタクトレンズを水和ステーションから検査ステーションへ移動させる装置も提供される。

【図面の簡単な説明】

【図１】検査キャリアでかつコンタクトレンズの最終的な包装の一部にもなるコンタクトレンズキャリアの等寸大図。

【図２】自動レンズ検査システムの全体を通して複数のコンタクトレンズキャリアを搬送するのに用いられる図１に示した検査キャリアの等寸大図。

【図３】本発明に係る脱イオン水ガス抜きシステムの構成要素を示すブロック図。

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【図４】脱イオン水をガス抜きするのに用いられるガス抜き真空タンクの詳細断面図。

【図５】本発明に用いられる機械系および流水系各装置の模式図。

【図６】複数のコンタクトレンズを収めた水和キャリアのすぐ上に位置する凸レンズキャリアの調節可能アレーを有する連接ロボット搬送ヘッドの側面図。

【図７】（Ａ）は湿潤したコンタクトレンズを水和キャリアの凹レンズ保持面から連接回動ロボットの搬送ヘッドにある凸レンズ保持面まで移行させる模様を示す模式断面図、（Ｂ）は自動レンズ検査の結果に誤った否定的な影響を与えかねない気泡をコンタクトレンズから除去する気泡吹き飛ばし機構の模式断面図である。

【図８】連接回動ロボットの延び出し位置における移行ヘッドを上から見た平面断面図。

【図９】連接回動ロボットの閉止位置における移行ヘッドを下から見た平面断面図。

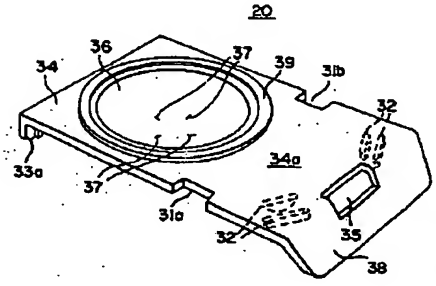
【図１０】本発明の方法に従ってパッケージキャリアにガス抜きした脱イオン水を充填する際に用いられる装置の側面図。

【図１１】図１０の装置の平面図。

【図１２】図４に示したガス抜き真空タンク内で用いられるガス抜きマニホールドの内の一本の側面図。

【図１３】図１２の１３－１３’線断面図。

【図１】



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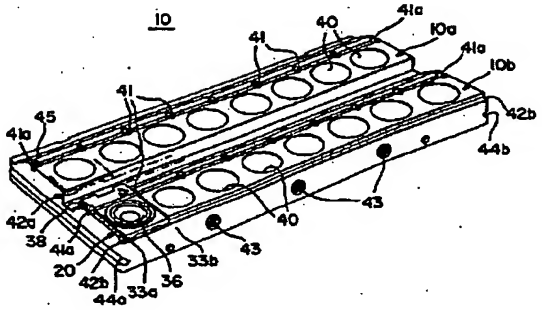
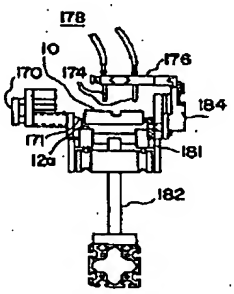


【図１１】



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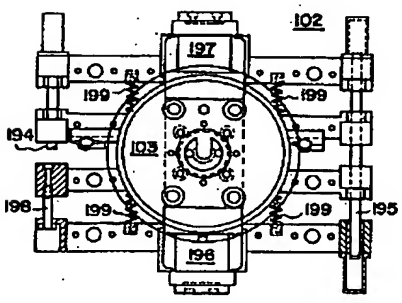

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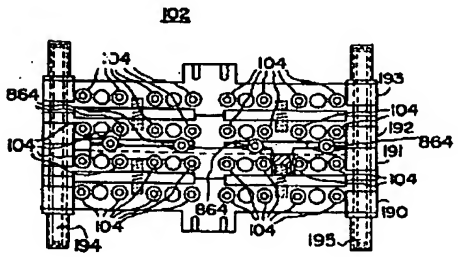

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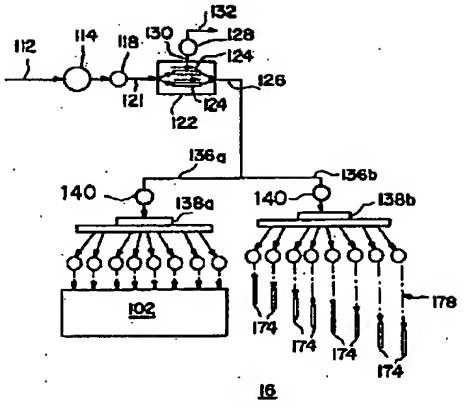
112
114
118
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126
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136b
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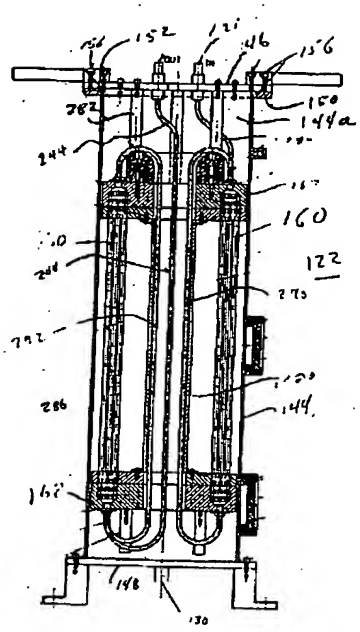
138a
140
138b
102
178
174
174
174
174
16

【図４】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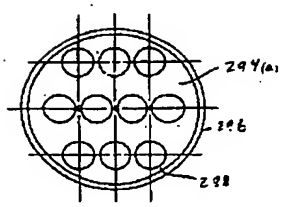
【図１３】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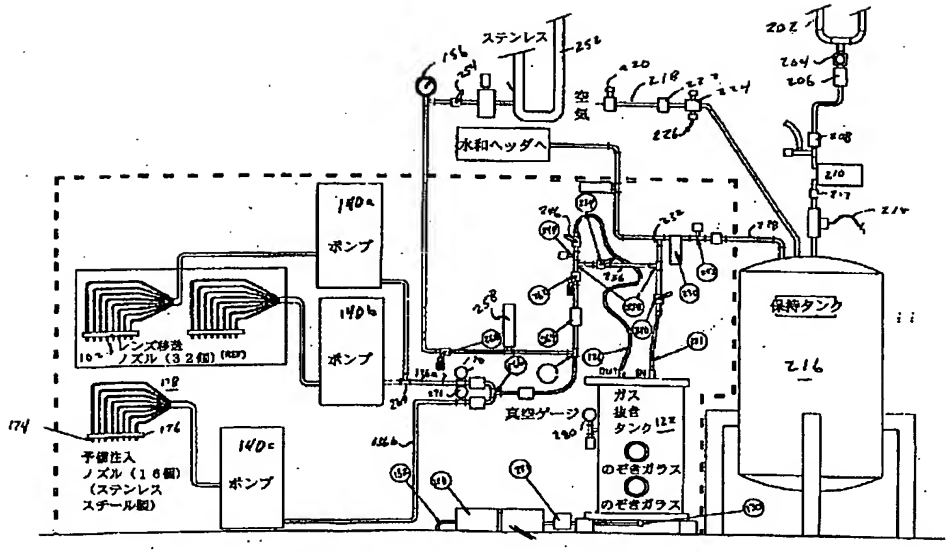
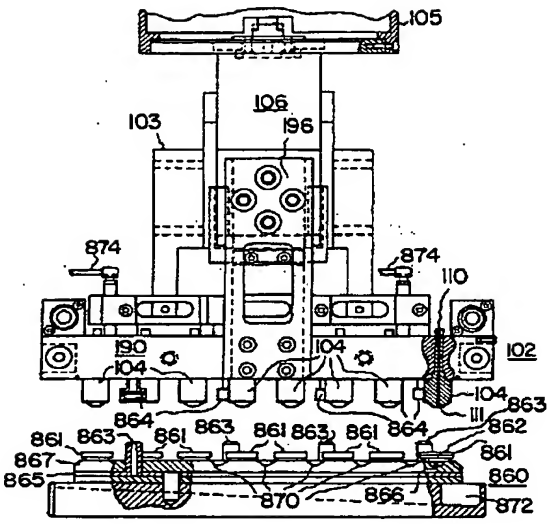
【図５】


ステンレス
空気
水和ヘッダへ
140a
ポンプ
140b
ポンプ
140c
ポンプ
レンズ移送
ノズル（３２個）
予備注入
ノズル（１６個）
（ステンレス
スチール製）
174
真空ゲージ
ガス
抜き
タンク
のぞきガス
のぞきガス
保持タンク
216

【図６】



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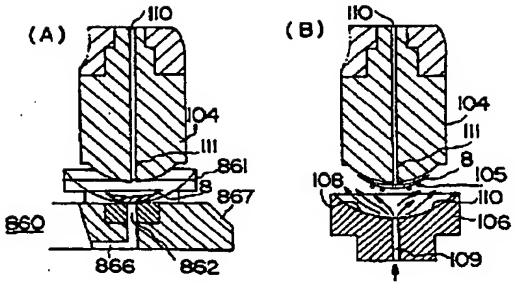
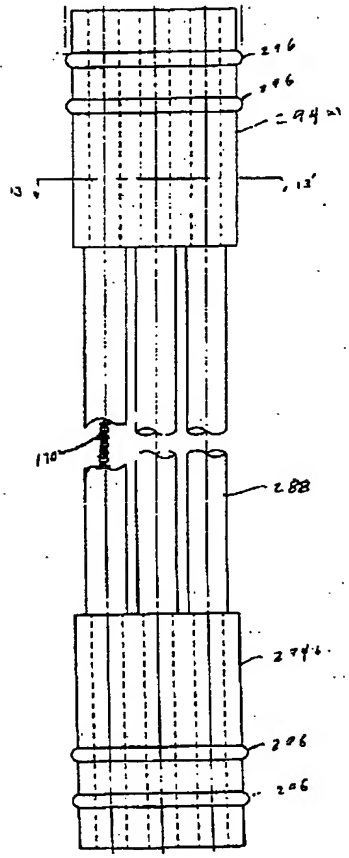


【図１２】



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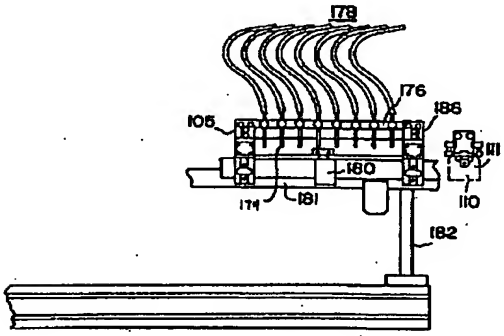

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English Translation of JP Publication No.: 10/010477 (Application No.: 09-046921)

TECHNICAL FIELD

[Field of the Invention] This invention relates to a hydrophilic contact lens [finishing / manufacture of the lens for ophthalmology, especially shaping], and in more detail, in order to inspect and pack a contact lens, it relates to the equipment and the approach of venting deionized water.

PRIOR ART

[Description of the Prior Art] shaping of a hydrophilic contact lens -- U.S. Pat. No. 4,495,313 (Larsen) -- said -- the 4,640,489th a number (others [Larsen]) -- said -- the 4,460,336th a number (others [Larsen]) -- said -- the 4,889,664th a number (others [Larsen]) -- and -- said -- the 5,039,459th A number (others [Larsen]) has a publication (finishing [transfer to these people] altogether).

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, the automatic gear which deals with and prepares a contact lens for inspection / package is offered. Moreover, according to this invention, between carriers, a lens can be moved and inspection of the lens in an automatic check means can also be made easy with the vented deionized water. And in advance of the inspection in automatic lens check system, the equipment from which the air bubbles generated on the surface of a lens are removed is also offered. In addition, the inspection approach which suppresses formation of air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection, to the minimum and which the fabricated contact lens has improved is also offered by inspecting a lens in the vented deionized water. According to this invention, the last is provided also with the equipment to which the station which blows away air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection was attached and which is made to move a contact lens to an inspection station from a hydration station.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] These conventional technical reference indicates the manufacture process of the contact lens which makes a monomer or monomer mixture the shape of sandwiches, and forms a contact lens between the piece for front (lower part) curves of a mold arranged in the 2 piece x4 piece array for shaping (array), and the piece for rear-face (upper part) curves of molding. A monomer is fabricated by the lens by the polymerization, and this lens is removed from the piece of a mold, is further processed by the hydration bath, and is packed for final use.
[0005] U.S. Pat. No. 5,080,839 -- and -- said -- the 5,094,609th The number is indicating the process which hydrates the contact lens formed from the monomer and monomer mixture which were indicated by each above-mentioned patent, and the chamber which hydrates a contact lens, respectively. The process indicated by these patents hydrates a lens with deionized water and a little surfactant (salts do not use),

and in order that it may reduce sharply the yield time amount taken to remove from the piece of a mold, it becomes unnecessary to give neutralization which time amount requires for the polymer which becomes the origin of a lens blank in a hydration process. When using deionized water, in the final process of a process, the physiological saline for a buffer is introduced into a final package, and, subsequently to under a package, a lens is sealed. this -- the inside of a package -- the final balance (setting in the semantics of neutralization, final hydration, and the last dimension of a lens) of a lens -- sterilization among a room temperature -- it is for being in process and making it attained.
[0006] Although U.S. Pat. No. 4,961,820 (finishing [this / transfer to these people]) is indicating the final package for contact lenses, this package is formed from the lamination of the foil heat sealed by a transparent polypropylene blister (blister) and this transparent.

MEANS

[Means for Solving the Problem] United States patent application 994,564th of the new expansion in inspection of the contact lens by the approach concerning each above-mentioned patent to these people Automatic lens inspection which was indicated in the number (name of invention : "the lens inspection approach and equipment") was produced. Furthermore, it is the United States patent application 258,556th which relates to these people from the hydration of the contact lens which carried out humidity, and the latest advance in automatic handling. The approach of carrying out the automatic handling of the lens by the robot into hydration in advance of inspection by automatic lens check system which is in a number (name of invention : "the automatic gear to which hydration of the soft contact lens is carried out, and an approach") was also born.
[0009] Then, the purpose of this invention is offering the automatic gear which deals with and prepares a contact lens for checking. Also let it be the purpose to deal with this invention further, in order to cover a contact lens over inspection and a package, and to offer the automatic gear (for a lens to be inspected the same with having stated previously and to be packed here) to prepare.
[0010] Furthermore, in order to make easy inspection of the lens in an automatic check means, it is also the purpose of this invention to move a lens between carriers with the vented deionized water. And it is also the purpose of this invention to offer the equipment from which the air bubbles generated on the surface of a lens are removed in advance of the inspection in automatic lens check system.
[0011] In addition, it is also the purpose of this invention to offer the inspection approach which suppresses formation of air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection, to the minimum and which the fabricated contact lens has improved by inspecting a lens in the vented deionized water.
[0012] Moreover, a lens is first fabricated in the disposable mold frame for contact lenses, and it is also the purpose of this invention to inspect and to offer the manufacture approach which the soft contact lens which performs neutralization which hydration and the time amount of the lens which packed in the physiological saline and was formed by the polymerization in this final package require has improved in the vented deionized water. And it is also the purpose of this invention to add the integration system which removes a defective lens from Rhine of an inspected lens in advance of a package by the above-mentioned all directions method.

[0013] Another purpose of this invention is offering the method of inspecting a contact lens in the vented deionized water, and the method of removing deionized water automatically after inspection.
[0014] Finally, this invention also makes it the purpose to offer the equipment to which the station which blows away air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection was attached and which is made to move a contact lens to an inspection station from a hydration station.
[0015] This invention is mainly the United States patent application 258,654th. Although the contact lens fabricated between the 1st [which is in a number (name of invention : "a contact lens shaping system")], and 2nd pieces of a mold is described, that it is suitable also like integration of the engine-lathe processing lens cut and ground so that it may have a desired optical surface should understand the equipment concerning the shaping system of this invention, maintain a hydrogel to dryness. Furthermore, the equipment of this invention can be used also for the integration system of the lens formed by the spin cast method fabricated in the configuration of a desired lens optical surface, applying a liquefied monomer to a centrifugal force.
[0016]
[Embodiment of the Invention] The equipment which vents deionized water to the inspection / package concerning above-mentioned this invention, and the purpose and advantage of an approach will be easily understood by this contractor by detailed explanation about a desirable mode given with reference to the drawing of the following attachment. In addition, in the attached drawing, the same reference mark was given to the element common to each drawing.
[0017] This invention is a thing for the part concerning the processing after the hydration in a contact lens automatic manufacturing installation. United States patent application 258,654th It is fabricated with an automatic production line which is in a number (name of invention : "the system which deals with the contact lens in hydration"), and is the United States patent application 994,564th. The contact lens by which the automatic check was carried out as it was in a number (name of invention : "the lens inspection approach and equipment") has the large place which participates in the advantage of this invention.
[0018] (After [hydration] process) This invention proposes the multiple-purpose disposable lens package carrier which transports a contact lens during inspection and works as a part of last package after inspection.
[0019] the suitable package carrier 20 shown in drawing 1 is manufactured from injection molding or a sheet-plastic ingredient like the polypropylene by which heat formation was carried out, and it has the pair of the insertion flanges 33a and 33b (only 33a is shown in drawing 1) for making it align on the package carrier treated by the robot in the inclination wall 38 which makes the 1st flange material at the end, and the other end -- the rectangular plane base member 34 is included mostly. This package carrier is the United States patent application 995,607th of these people. It is indicated in detail by the number (name of invention : "the lens package for ophthalmology"). The insertion notches 31a and 31b are formed in each ** of the base 34, and these notches have two incomes with a package carrier and the insertion pin in the various support pallets used in processing / package actuation which covers a lens over the further handling and processing. The opening 36 of almost a semi-sphere which is formed in a package at one and is in agreement with the curvilinear configuration of a contact lens (not shown) shifts from the core of a package, and is prepared. A contact lens is stored in this opening 36 in the state of seal, while being

examined by the suitable sterilization water solution by the same approach as U.S. Pat. No. 4,691,820 (Martinez; finishing [transfer to these people]). Height h of the flange 38 prolonged from the base member 34 complements the depth of an opening 36, and in case it has two incomes with the flanges 33a and 33b in the pallet carrier of the special configuration mentioned later, it enables the self-array (self alignment) of a package carrier. It is used by the flange 38 again also in the case of the last package of a product, having two incomes with the upheaval 32 (in order to stuff carton for shipment after this, assistance which supports the opening structure of the package carrier set in **** repetition **** is carried out) of two or more "Chevron (**** of Yamagata)" configurations.

[0020] An opening 36 includes two or more marks 37 for collating again. While removing deionized water by one of the processing stations after hydration, this mark is used in case it assists holding a contact lens to the mid gear of an opening. A package carrier is equipped with the annular flange 39 used for heat sealing lamination covering of a foil again in order to maintain a contact lens at an airtight condition in the case of shipment. In order that a user may use a lens, in case the clipping section 35 removes the lamination of a covering stock or a foil, it is used for making grasping of a flange 38 and a package easy.

[0021] The base member 34 contains smooth flat-surface 34a which offers the engagement band suitable again for a vacuum gripper with the bottom. This flat-surface 34a is used for transporting a package carrier in each phase of a production line.

[0022] Drawing 2 shows the inspection carrier which transports a package carrier in a lens automatic check system. The inspection carrier 10 includes the 1st and 2nd trains 10a and 10b of the opening 40 which offers the path for storing the ball 36 of a package carrier and viewing a lens automatic check system. The engagement pin 41 prepared in each ** at equal intervals engages with a package carrier, and edge engagement pin 41a merely engages with the package of a piece. These engagement pins engage with the engagement notches 31a and 31b of a package carrier, and attain exact engagement on a package carrier in the longitudinal direction of an inspection carrier. It prevents that the another side hard edges 42a and 42b serve as a mark of agreement of the flanges 33a and 33b which prolonged and came out downward, and a carrier package rotates them with a pin 41. The hole 43 further for three engagement is established in each ** of the inspection pallet 10. In case these holes transport the inside of an automatic lens inspection station for a pallet or perform wearing and removal for a package carrier, when a pallet is fixed to a position, they are used. The pair of the slots 44a and 44b for grasping the overhead migration system which installs an inspection pallet in an inspection pallet in addition to this at automatic lens check system, and is removed after this is prepared. The pair of a slant face 45 gives a clearance for the flange 38 which prolonged and came out to the bottom in the package carrier 30 to enter.

[0023] As shown in drawing 1 , there are two purposes in the lens carrier 20 made from polypropylene. One is becoming a carrier at the time of inspecting a lens with automatic lens check system, and another is becoming a container for a final package of the lens at the time of shipping to an end user. These package carriers are typically fabricated by the predetermined array by total of 4x4 trains [16] per 1 molding cycle, and are removed from the mold of injection molding by the robot migration means.

[0024] Subsequently to a pallet loading station, a package carrier is laid in the existing inspection pallet 10. In a desirable mode, a package carrier is fabricated in 4x4 arrays in order to make manufacture effectiveness in such an array max, but in case it moves

to an inspection pallet, it is made into 2x8 arrays. Subsequently the inspection pallet 10 loaded with a package carrier is a conveyor, and is conveyed to the deionized water injection station 16 indicated to be drawing 10 to 11. Each package carrier conveyed with the inspection pallet 10 is this deionized water injection station 16, and is filled up with the deionized water vented to the part. The inspection pallet 10 is transported to lens loading area by push conveyor after this. In this lens loading area, batch processing is carried out by the 2nd pallet so that the contact loading area where a total of 32 package carriers with which it filled up with the deionized water by which gas drainage was carried out stand in a row may be given.

[0025] (Gas drainage of deionized water) This invention is the United States patent application 994,564th. The gas drainage finishing deionized water containing a surfactant little as an inspection medium for automatic lens check system in a number is used.

[0026] When using only deionized water for a package carrier ball, friction and a hydrophobic suction force may arise between a contact lens and a carrier front face, and the impression which bars moving a lens to a desired location may occur. For example, in a certain well-known process, a contact lens is formed from a liquefied HIDOROGE monomer, and as it is in U.S. Pat. No. 4,495,313, a polymerization is carried out under existence of a diluent with inactive sand-proof ester etc. This inactive diluent is filled up with the opening of the hydrogel lens between polymerizations, and, subsequently is exchanged for deionized water in a hydration process.

[0027] By the way, also after a hydration process is completed, since a small amount of acid radical may remain on the surface of the lens, when a lens is laid in the impression of a lens carrier, a lens may adhere to the ball front face of a carrier for these acid radicals. If it does so, since free migration will be checked, a lens may not move to a desired location. When such a situation happens and a lens is inspected with automatic lens check system, since a lens does not go into an inspection visual field, it may be refused, or may be accidentally judged as a defective.

[0028] United States patent application 258,266th In a number (name of invention : "the surfactant which locates the object of optical inspection in the center"), it has proposed adding a little surfactant to deionized water as a solution over this problem. It assists that a surfactant prevents that reduce friction between an impression and the front face used as a lens and a lens holder, and a hydrophobic suction force occurs, and a lens can draw near certainly to a desired location.

[0029] Various surfactants can be used for this invention. For example, it is known for the trade name of polysorbate (Polysorbate) 80 or tween 80, tween 80k0, etc. by polyoxyethylene 20 sorbitan monooleate. If tween 80 is added by the concentration of 25 section extent per solution 1 million section, although a lens can move in the inside of the package carrier 20, without adhering, it can be used also by concentration higher than this. For example, 0.01 - 5.0 % of the weight is sufficient as the concentration in a solution. Since a surfactant builds a desired solution, it is mixable with suitable liquid carriers (support), such as deionized water.

[0030] The concentration of the surfactant in a solution has the desirable minimum of the density range described in the top. For example, it may be lower than the 50 sections per deionized water 1 million section. If a surfactant is used by such low concentration, it will be avoided that a surfactant foams and a surfactant will be made as for it to below predetermined concentration.

[0031] In case it is made to blow off under a low-pressure (atmospheric pressure) environment from fluid Rhine which compressed water, in order to prevent that air

bubbles or the bubble of gas generates, it is desirable to use the vented water. If the deionized water which is not vented is used, it is generated in a package, or in case small air bubbles move a contact lens to a package carrier before moving a lens, they will arise on a contact lens. It is generated from the gas which is dissolving in deionized water, and these air bubbles serve as a kind (seed) of a lens, or unevenness with a small package carrier front face.

[0032] The equipment which vents deionized water is shown in drawing 3 -5. Drawing 3 is the mimetic diagram of a gas drainage module, and another side drawing 4 is the detailed longitudinal direction sectional view of the gas drainage unit 122. Deionized water is supplied through an input line 112 from the source of deionized water (it also becomes a source of supply at the time of hydration). When leading water from a container, an air blanket is covered over a deionized water tank or a pump 114.

[0033] Deionized water lets a filter 118 pass in order to remove the particulate contaminant from the outside which has a possibility that it may be contained, subsequently to underwater.

[0034] Deionized water is supplied to the inlet port of the gas drainage unit 122 after this. In the gas drainage unit 122, deionized water branches in two or more tubes 124 arranged at the manifold, and joins again by the exhaust port 126 of the gas drainage unit 122. The gas drainage unit 122 drives a vacuum pump 128, and is operated under low voltage (typically 4 - 25torr). It connects with the gas drainage unit 122 through tubing 130, and this vacuum pump 128 discharges superfluous air from a gas drainage unit through tubing 132.

[0035] If deionized water comes from the gas drainage omission unit 122 outside through an exhaust pipe 126, it will flow into Manifolds 138a and 138b through Tubing 136a and 136b and the precision perfusion pump 140. A manifold is used in the impregnation station 16 and the robot shift array 102 attached in robot shift equipment as a common source of supply which provides each package carrier for contact lenses with two or more nozzles. In the pump 140 which sends out the vented deionized water to a manifold 138, it is a FMI pump (Fluid Metering of New York State Oyster Bay, product made from Inc.) Oyster Bay Pump Works of New York State Oyster Bay, and Inc. It attached and used for the pump driving gear of manufacture. Only an exact amount pours the solution of gas drainage finishing deionized water into a package ball, and these pumps suppress generating of air bubbles and adhesion of a lens, prevent that to which a solution overflows (water will adhere to the seal field of a package), and can control it to the amount of water suitable for check system.

[0036] If drawing 4 is seen here, the gas drainage unit 122 for monomers is shown in this drawing at the detail. This gas drainage unit 122 includes the pressure field which consists of the side attachment wall 144, the top plate 146, and the pars-basilaris-ossis-occipitalis plate 148 of a cylindrical shape. The hole 130 which stands in a row in a vacuum pump 128 is established in the business shown in the pars-basilaris-ossis-occipitalis plate 148 at drawing 5 .

[0037] The top plate 146 is attached in the side attachment wall 144 of a cylindrical shape using a flange 150 and O ring 152 (compressed between a flange and a top plate). Compression of O ring 152 and anchoring to the flange of the top plate 146 are performed using the bolt 156 which attaches the top plate 146 in a flange.

[0038] The inhalant canal 121 of water is prolonged through the top plate 146, branches in two or more tubing of desirable equal die length by the Y shape connector within chamber 144a, gives the equal back pressure, and realizes a uniform flow rate

to each branching. These tubing is connected to the silicon manifold 160. Inside a gas drainage tank, 2-10 silicon manifolds (it has ten tubes which penetrate gas, respectively) are arranged. These six manifolds are used in the desirable mode of this invention. The manifold 160 connects in order what has arranged two in parallel.
[0039] The internal structure of a gas drainage unit is attached in the pair of the blocks 167 and 168 made from Dirline which support both the pipe of a manifold, and the gas transparency manifold 160. The block 167,168 made from Dirline of a gas drainage unit may be hung from the top-face flange 146 using a harness 282,284. And this top-face flange 146 hangs a top-face block and a harness 286,288, and these harnesses 286,288 hang a base block. The water with which passage flows from the 1st parallel array toward a top to the bottom returns to a crowning towards the 2nd array equipped with the tube 290. And next, it progresses to the following parallel array through a tube 292 from this 2nd array. Finally the water which carried out gas drainage progresses to the emission tubing 126 through the discharge pipe 244 toward a top outlet.
[0040] While piling up in the manifold made from silicon, the gas which dissolved is led through the outlet of a chamber 130 by the vacuum generated with the pump 126, and shifts from deionized water through the tube wall of a manifold 160. When water approaches the crowning of a chamber, the gas which dissolved is exhausted mostly.
[0041] One of the manifolds 160 is indicated to be drawing 12 to 13. Among these, drawing 12 is the partial diagrammatic view which the manifold 160 expanded, and drawing 18 is the 13-13' line sectional view of drawing 12 . As shown in drawing 13 , each manifold 10 contains two or more tubes 288 arranged by -four -three [three]. Each tube 288 is attached in the manifold anchoring blocks 294a and 294b which really which closes a manifold to the anchoring block 167,168 made from Dirline contain the closure member 296.
[0042] In order to raise the effectiveness of extensive migration, a static mixer 170 (the piece of them is shown in drawing 12) is installed in each tube of a manifold 160. These static mixers (Koflo of the Illinois carry shrine manufacture) are the products made from Dirline, a diameter is 1/4 inch and die length is 6 inches.
[0043] An ingredient desirable for a gas permeability tube is the STHT tube made from Sanitech of New Jersey Andover (it manufactures from the silicone rubber of Q74780 medical-use grade of the Dow Corning manufacture of Michigan Midland).
[0044] The equipment of this invention is arranged so that each manifold 160 may contain ten tubes. 1-/8 - 1/2 inches of 1-/16 - 1/32 inches of 1/4 inches and wall thickness of each tube is [a bore] 1/32 inch preferably, and a durometer degree of hardness is 80.
[0045] From silicon or other impermeable ingredients, it can have a header tube in the crowning and pars basilaris ossis occipitalis of a tank, and it can come. Each makes these tubes the same die length so that the differential pressure which becomes flow the origin which imbalance produces may not arise. Subsequently to one, each header tube is connected to a Y shape so that the outlet of gas drainage equipment may be carried out.
[0046] the stream which uses drawing 5 by this invention -- it is the mimetic diagram of a system. In this drawing, deionized water is supplied from the recycling supply pipe 202 through the pneumatic valve 210 of a latching valve 204, a filter 206, a flowmeter 208, and the electric actuation type that controls supply of deionized water electrically. A check valve 212 and the manual system latching valve 204 isolate in order to carry out recycling of the deionized water in a conduit 202. A supply pipe 214 supplies what carried out little measuring of a surfactant like tween 80 described

previously.
[0047] Deionized water is compressed with the air blanket (air blanket) supplied from a distribution system through the conduit 218 which has the electric actuation type solenoid valve 224 which was stored in the maintenance tank 216 and equipped with the pressure regulator 220, the air filter 222, and the rapid exhaust port 226.
[0048] the normal operation of equipment -- setting -- the deionized water in a tank 216 -- 10-20psi -- desirable -- 15psi(s) It is compressed with the maintained blanket of pneumatic pressure. From the deionized water tank 216, deionized water is led to the 1st T character manifold 232 through a conduit 228 and a filter 230, and branches in the style of [two] a process here. One of these process styles is the United States patent application 256,556th described above. Water is supplied to the hydration equipment in a number (name of invention : "the automatic gear which hydrates a soft contact lens, and an approach").
[0049] the bypass system containing a bypass valve 234 and a branch pipe 236 -- a pair -- T characters connects with a system through a conduit 238. In normal operation, the closedown of the bypass valve 234 is carried out, deionized water passes along the T character manifold 238, a latching valve 240, and the inlet-port tube 121, and even the gas drainage tank 122 of this invention advances. the vented deionized water -- the time of supply -- the outlet from the gas drainage vacuum tank 122 -- it progresses to a lens transfer nozzle and an inspection package through a conduit 244 and a valve 246.
[0050] In order to take out a sample at the time of a request, the holes 248 and 250 for samples are formed. If the connector of the collar head in the inlet-port tube 242 and the outlet tube 244, an inlet valve 240 and an outlet valve 246, and a bypass valve 234 are used, a system will be bypassed through the shunt 236 which faces to the gas drainage vacuum tank 122, and continuation actuation of a production line will be maintained at the time of wastewater.
[0051] In the steamy recycling tubing 252, it is the United States patent application 432,927th. As it is in a number (finishing [transfer to name: "online steamy plumbing equipment" of invention, and these people]), in order to sterilize a distribution tube periodically, a latching valve 254, the pressure gage 256, and a filter 258 are formed. In the case of normal operation, steamy supply is performed by [as not becoming together with supply of the vented deionized water using the shut-off valve 260 of a lock type]. These two valves isolate distributive system and it is made for a steam not to go into a gas drainage vacuum tank and a deionized water tank. Moreover, a check valve 264 is also installed so that neither deionized water nor a steam may enter into a system during sterilization of distributive system.
[0052] The output of a gas drainage system branches through 1st T typeface manifold 266 and 2nd T typeface manifold 268, and three main systems concerning the gas drainage finishing deionized water of this invention are obtained. In order to measure the pressure of each main system, the pressure gages 270 and 272 are formed. The pair of the precision metering pumps 140a and 140b is sent out to the lens transfer nozzle used in case the lens which showed gas drainage finishing deionized water to drawing 6 -9 is transported to the following system from a certain system. 3rd precision metering-pump 140c is sent out to the manifold 178 which showed gas drainage finishing deionized water to drawing 10 , and two or more nozzles 174. These nozzles measure gas drainage finishing deionized water correctly, and inject it into the pallet 10 with which two or more carriers 20 for an inspection package already explained in drawing 1 were settled.
[0053] The gas drainage vacuum tank 122 is equipped with the vacuum gage 280, the

vacuum port 130, the pressure-sensitive switch 282, a vacuum pump 128, and the exhaust port 132 that discharges air and the pressed-out deionized water in a drain system. As already stated, the pressure of a tank 122 is usually maintained by 4 - 25torr using the vacuum pump 128 by which a switch change is carried out. When operating gas drainage equipment to usual, a small amount of deionized water penetrates the curve of the silicon tube 160, and is pressed out, and a vacuum pump 128 is a diaphragm pump which can deal with little water at the time of normal operation.

[0054] (Preparation before inspection) This invention is the United States patent application 258,556th. It suits, especially in case invention indicated by the number (finishing [transfer to name: "the automatic hydration equipment of a soft contact lens and an approach" of invention and these people]) carries out.

[0055] As shown in drawing 6 , the hydration carrier 860 which carried plurality, for example, 32 contact lenses, moves from hydration equipment to a migration location. Depending on each convex lens carrier, the lens of a piece is merely conveyed. Subsequently to drawing 6 and drawing 7 (A), the robot concrete supply system equipped with 4x8 arrays 102 (recombination is also possible) of a convex lens carrier which carries out connection rotation locates an array in the shown upper part of 2nd hydration carrier 860a.

[0056] As shown in drawing 7 (A), only one contact lens 8 is conveyed by the concave lens carrier 861, and is held immediately under the convex lens carrier 104 installed on 4x8 arrays 102. The concave lens carrier 861 includes at least one port 862 for introducing a fluid between the front face of a concave lens carrier, and a lens 8. A fluid is supplied through the channel 866 which cut off the upper part plate 867 bottom. This channel 866 connects a fluid manifold and two or more fluid connectors 863, and is prolonged to the surface upper part of the concave lens carrier 861 with which the fluid connector 863 is best shown in drawing 6 R> 6. The fluid connector 863 is made into a configuration which engages with the fluid coupling 864 formed in the 4x8 array 102 bottom. the object for fluids which supplies the fluid for migration used for these coupling transporting a contact lens 8 from the concave lens maintenance means 861 to the convex form lens maintenance means 104, respectively -- it connects with a conduit 874.

[0057] It is desirable that migration of a fluid twists a contact lens to pneumatic pressure in the mode which is transported to the robot array 102 from the hydration carrier 860 and which is shown in drawing 6 . therefore, the conduit 874 -- the compressed air is sent to coupling 864 and the coupling member 864 sends the compressed air to the fluid coupling 863, the channel path 866, and a port 862 delivery and shortly.

[0058] As shown in drawing 7 (A), after hydrating a contact lens 8 at a hydration station, it is still moist only with water having been dropped. Furthermore, in order to make easy to deal with it the contact lens which became wet by bringing near a lens in the center within the concave surface of the lens maintenance means 861, hydration of the lens is carried out by the deionized water containing a little surfactant. For this reason, if air compression Rhine 874 is operated, extrusion with air takes place through a port 862, and a contact lens can be pulled up from the front face of a concave lens carrier to the upper part, and will engage with the convex form lens carrier 104. While the lens has adhered without a surfactant or this to the convex form lens carrier 104, a surfactant wets the front face of the convex form lens carrier 104, and increases the adhesion force to this front face with the surface tension of deionized water, and surrounding atmospheric pressure. In order to secure direct and

exact migration in the case of migration, as for each convex form lens carrier 104, it is desirable that you make it located in a 1.5mm lens.
[0059] after transporting a lens 8 to the convex form lens carrier 104, a robot concrete supply system equips the manifold which has two or more cup members 104 (one of pieces of this was shown in drawing 7 (B)) which resembled the manifold 860 in the array of a lens -- "-- cellular ******** is carried out and it is made to move to" station Each cup member contains the concave surface 108 of the almost same configuration as the convex of the 2nd convex form lens carrier 104. Although the concave surface of this cup member understands that such a concave surface 108 is desirable, the same function is obtained also with single jet equipment. A concave surface 108 includes at least one port 110 for taking in a compression fluid through the central path formed in the cup member again. Although it will become easy to move a lens to the 2nd carrier from the 1st carrier if a little surfactant is included in deionized water, on the other hand, generating of the small air bubbles 105 is caused in the layer of wrap deionized water for a contact lens 8. If it puts to the compression fluid which spouts a lens, the small air bubbles 105 will shift and disappear outside, before transporting a lens to an inspection carrier. In order to prevent that the negative data mistaken by automatic lens check system are taken, it is desirable to remove such air bubbles. Deionized water can also be used although the compressed air was used in the desirable mode of this invention.
[0060] (Impregnation to a package carrier) As drawing 3 and 5 were explained, gas drainage of the deionized water is carried out in the gas drainage unit 122, and it is distributed to a deionized water impregnation station (it is indicated in 11 as drawing 10 in detail) by two or more precision perfusion pumps 140. As shown in drawing 11 , band-conveyor 12made of rubber a equipped with the pair of a belt conveys the inspection carrier 10 from the package carrier loading area 11 (shown in drawing 3) to the deionized water impregnation station 16. In order to stop a series of inspection carriers 10 to the upstream of the impregnation station 16, pneumatic pressure ****** 170 equipped with the click 171 is used. When loading with the new inspection carrier 10, the pneumatic pressure juice press style 170 draws a click 171, and the inspection carrier 10 is conveyed at the impregnation station on conveyor 12a. The group of the isolated jaw which was attached in another pneumatic pressure lock device engages with the inspection pallet 10 by the same approach, and holds this firmly in a package impregnation location. Two or more impregnation nozzles 174 are attached in the level round trip beam supporter material 176, and are connected to the FMI precision perfusion pump 140 through two or more tube members 178. Each pump is connected to each nozzle at this time. Termination of each nozzle 174 is carried out with the gage Teflon needle which is 16 pieces whose bores are 0.045-0.048 inches, and it is hung above the ball member 36 in more detail immediately on the package carrier 20. In the case of actuation, the pneumatic cylinder 180 firmly fixed to the support frames 181 and 182 makes the conveyance member 184, the perpendicular support 185,186, and the water Biratori attachment beam 176 go, and locates the tip of a Teflon needle caudad from the ball 36 with which the package carrier 20 became depressed. The tip of a Teflon needle is turned caudad, and it goes and comes back to it, and it lets this needle pass, and since about 600ml gas drainage finishing deionized water is filled up with a ball 36 in part, it is poured in. It can pull up, in order that a pneumatic cylinder 180 may operate and the both-way supporting beam 176 may lift a Teflon needle from the package carrier 20, if predetermined deionized water is poured into a ball 36. In case gas drainage finishing deionized water is poured in, it becomes unnecessary to agitate, if the impregnation needle

which reciprocates is used. If unsuitable churning is carried out, air will be incorporated and it will lead to generating (it becomes the origin of the mistaken negative inspection result) of air bubbles. Subsequently, the inspection carrier 10 comes out of the impregnation station 16, and goes to the edge of conveyor 12a. And it engages with the push conveyor which crosses the platform of stainless steel and pushes in the inspection carrier 10 to lens inspection loading area here.

[0061] Although 2x8 pieces and 4x8 arrays are used in the processing section after the hydration concerning this invention, it could be understood in this invention that the array of various arrays can be used.

[0062] 4x8 arrays of the hydration carrier 860 shown in drawing 6 differ from 4x8 arrays of the package carrier in the lens loading area formed of the pair of a pallet 10. 4x8 arrays to which 4x8 arrays 102 attached in the robot migration means 100 have the dimension of 30mm around between lenses in the hydration carrier 860 -- and -- "-- it can adjust so that cellular ******** may be carried out and the" station 70 may be stored, and if it does so, it will expand to the dimension of 30x50mm. This in the lens loading area (by the way, drawing 8 and 9 explain) formed of the pair of the inspection pallet 10 is equal to the dimension of the 3rd 4x8 array.

[0063] A pattern that contraction arrangement of this array was carried out again at drawing 9 in 4x8 arrays 102 by which expansion arrangement was carried out is shown in drawing 8 . An array 102 contains 32 convex type lens carriers 104 which explained drawing 6 and 7 previously. Along with the center line of an array, four fluid coupling members 864 which make a conduit 863 engage with the 2nd hydration carrier 860 are located in a line. An array consists of four Rhine 190-193 where each conveys eight convex form carriers 104. Nucleus Rhine 190-193 is installed so that drawing 8 may explain in detail, and it may go along with the internal guidance rods 194 and 195. The pneumatic pressure chucks 196 and 197 are formed in each ** of an array, and as shown in drawing 8 , they draw outside Rhine 190 and 193 which is in actuation and coincidence in the outermost part along with the guidance rod 194,195. The outermost arrays 190 and 193 are the pairs (a sign 198 shows one of pieces [them] to drawing 8 .) of internal slide ******, respectively. the role to which this pulls out innermost Rhine 191 and 192 outside -- carrying out -- it conveys. At this time, Rhine 190 pulls Rhine 191 and Rhine 193 pulls Rhine 192. Compression spring 199 assists dividing each Rhine of an array again.

[0064] It should also care about that it can rotate around a turntable 103 in order to give suitable bearing for an array, in case an array 102 transports a lens to lens loading area from a hydration station. Since a turntable 103 is attached in the 1st and 2nd connection arms, the perfect direction of three dimensions can be made to move among the various migration points which a robot concrete supply system gives to 4x8 arrays.

[0065] the interior which carries out termination of the convex form lens carrier 104 in at least one port 111 again as shown in drawing 7 (A) and drawing 7 (B) -- a conduit 110 is included. This port 111 uses a fluid for introducing into a convex form lens carrier and a contact lens 8 in between. Although arrays 190-193 spread so that it may align with each convex form lens carrier 104 when the array 102 is located above two or more lens carriers 20 in lens loading area It is immediately under [it] the package carrier 20 related at this time. A little (usually 300microl) gas drainage finishing deionized water It is sent out through a conduit 110 by the precision perfusion pump 140, and even the ball 36 of the convex form carrier 104 to the package carrier 20 transports a contact lens 8. If gas drainage finishing deionized water is used also here, from the gas which the lens was dissolving into deionized

water, small air bubbles cannot generate and be afraid (this may serve as a "seed" on a contact lens 8), and can move. If a lens 8 is transported to the package carrier 20, 4x8 arrays 102 will be crushed using a pneumatic chuck 196,197 (drawing 8), and they will be returned to a form so that the configuration of the hydration carrier 860 may be suited.

[0066] If lens loading area is loaded with the pair of the inspection carrier 10, the 2nd servo motor drive type push arm will transport both pallets from lens loading area even to an overhead double shaft conveyance carrier. This conveyance carrier takes out one of inspection carriers, and it picks it up in order to send to an automatic lens inspection station. About this, it is the United States patent application 258,557th. It has indicated in the detail at the number (name of invention : "the automatic gear for preparing a contact lens, and an approach").

[0067] As mentioned above, although this invention has been **(ed) and explained to a desirable mode, if it is this contractor, adding modification to the mode stated on these specifications in the range which does not deviate from the publication of a claim may recollect.

[0068] The concrete embodiment of this invention is as follows.

1) Said fluid supply means is robot equipment possessing the vacuum gas drainage equipment for supplying deionized water [still finishing / gas drainage] to said 2nd fluid means according to claim 1.

2) Said vacuum gas drainage equipment is robot equipment of the embodiment 1 above-mentioned publication equipped with a means to produce the differential pressure for passing deionized water through two or more gas permeability tubes which think deionized water to be a vacuum chamber to gas drainage, and this gas permeability tube.

3) Said vacuum gas drainage equipment is robot equipment of the embodiment 2 above-mentioned publication further equipped with the vacuum pump which maintains the vacuum level in the inside of said vacuum chamber to 4 - 25torr.

4) The process which vents said deionized water is an approach according to claim 2 performed in vacuum gas drainage equipment in advance of the process filled up with said a part of inspection carrier.

5) It is the approach of the embodiment 4 above-mentioned publication which said vacuum gas drainage equipment is equipped with two or more gas permeability tubes which were attached in a vacuum chamber and this chamber, and which are received for gas drainage processing of deionized water, and includes the process which produces differential pressure for said gas drainage process to send in deionized water through said gas permeability tube.

[0069] 6) Said vacuum gas drainage process is robot equipment of the embodiment 5 above-mentioned publication which includes further the process which maintains the vacuum level in the inside of said vacuum chamber to 4 - 25torr.

7) The process which maintains said differential pressure is robot equipment of the embodiment 6 above-mentioned publication attained by covering the deionized water storing tank which supplies deionized water to said gas drainage equipment with an air blanket.

8) Said gas permeability tube is equipment according to claim 3 with which a durometer degree of hardness is formed from the silicone rubber of 80.

9) For 1 / 8 - 1/2 inch, and wall thickness, a bore is [said each gas permeability tube] equipment of the embodiment 8 above-mentioned publication it is [publication] 1 / 16 - 1/32.

10) The bore of each of said gas permeability tube is equipment of the embodiment 9

above-mentioned publication which is 1/4 inch.
[0070] 11) The wall thickness of each of said gas permeability tube is equipment of the embodiment 9 above-mentioned publication which is 1/32.
12) Said each gas permeability tube is equipment of the embodiment 9 above-mentioned publication bundled by two or more gas drainage manifold assemblies.
13) Said deionized water is equipment of the embodiment 12 above-mentioned publication which forms serial passage if each tube of said manifold is supplied and it is in said manifold, forming parallel passage.
14) Said equipment is equipment possessing the storing tank which contains further the deionized water which carries out gas drainage processing according to claim 3.
15) A means to make said differential pressure occur is equipment of the embodiment 14 above-mentioned publication which is the air blanket of ascendancy maintained in said storing tank.
[0071] 16) Said manifold is equipment possessing two or more nozzles attached above two or more contact lens packages according to claim 3.
17) Said manifold is equipment of the embodiment 16 above-mentioned publication which reciprocates perpendicularly in case deionized water [finishing / said gas drainage] is distributed to said contact lens package.
18) It is equipment of the embodiment 17 above-mentioned publication which can be perpendicularly pulled up from said package if said nozzle enters perpendicularly at said contact lens package, and the flow of said deionized water measured precisely ends while the tip of each of said nozzle is immersed in said distributed gas drainage finishing deionized water, and the flow of said deionized water ceases as for the tip of said nozzle.
19) It is equipment according to claim 3 which two or more contact lens carriers are contained in said two or more distribution points, and divides the lens anchoring side of a convex form in which each of this carrier stores a contact lens, and the path of the fluid which introduces said vented deionized water between the contact lens anchoring side of said convex type, and the field of a convex form.
[0072]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] Same size Ozu of the contact lens carrier which is an inspection carrier and becomes a part of final package of a contact lens.
[Drawing 2] Same size Ozu of the inspection carrier shown in drawing 1 R> 1 used for conveying two or more contact lens carriers through the whole automatic lens check system.
[Drawing 3] The block diagram showing the deionized water gas drainage structure-of-a-system element concerning this invention.
[Drawing 4] The detail sectional view of the gas drainage vacuum tank used for venting deionized water.
[Drawing 5] the mechanical system and stream which are used for this invention -- the mimetic diagram of system each equipment.
[Drawing 6] The side elevation of the connection robot conveyance head which has the array of a convex lens carrier which is located immediately on the hydration carrier which stored two or more contact lenses, and which can be adjusted.
[Drawing 7] The type section Fig. showing a pattern that (A) makes the contact lens which carried out humidity shift to the convex lens maintenance side which is in a

connection rotation robot's conveyance head from the concave lens maintenance side of a hydration carrier, and (B) are the type section Figs. of the cellular ******** device which removes the air bubbles which may have negative effect which was mistaken in the result of automatic lens inspection from a contact lens.
[Drawing 8] The flat-surface sectional view which a connection rotation robot began to be prolonged and looked at the shift head in a location from the top.
[Drawing 9] The flat-surface sectional view which looked at the shift head in a connection rotation robot's closedown location from the bottom.
[Drawing 10] The side elevation of the equipment used in case it is filled up with the deionized water vented on the package carrier according to the approach of this invention.
[Drawing 11] The top view of the equipment of drawing 10 .
[Drawing 12] One side elevation in the gas drainage manifold used within the gas drainage vacuum tank shown in drawing 4 .
[Drawing 13] The 13-13' line sectional view of drawing 12 .

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001] this invention -- United States patent application 258,557th A number (June 10, 1994 application) and United States patent application 432,957th a part of number (May 1, 1995 application) (the automatic gear and the approach the name of invention both prepares "contact lens for inspection and a package") -- it is continuation application.
[0002]
[Field of the Invention] This invention relates to a hydrophilic contact lens [finishing / manufacture of the lens for ophthalmology, especially shaping], and in more detail, in order to inspect and pack a contact lens, it relates to the equipment and the approach of venting deionized water.
[0003]
[Description of the Prior Art] shaping of a hydrophilic contact lens -- U.S. Pat. No. 4,495,313 (Larsen) -- said -- the 4,640,489th a number (others [Larsen]) -- said -- the 4,460,336th a number (others [Larsen]) -- said -- the 4,889,664th a number (others [Larsen]) -- and -- said -- the 5,039,459th A number (others [Larsen]) has a publication (finishing [transfer to these people] altogether).
[0004]
[Problem(s) to be Solved by the Invention] These conventional technical reference indicates the manufacture process of the contact lens which makes a monomer or monomer mixture the shape of sandwiches, and forms a contact lens between the piece for front (lower part) curves of a mold arranged in the 2 piece x4 piece array for shaping (array), and the piece for rear-face (upper part) curves of molding. A monomer is fabricated by the lens by the polymerization, and this lens is removed from the piece of a mold, is further processed by the hydration bath, and is packed for final use.
[0005] U.S. Pat. No. 5,080,839 -- and -- said -- the 5,094,609th The number is indicating the process which hydrates the contact lens formed from the monomer and monomer mixture which were indicated by each above-mentioned patent, and the chamber which hydrates a contact lens, respectively. The process indicated by these patents hydrates a lens with deionized water and a little surfactant (salts do not use),

and in order that it may reduce sharply the yield time amount taken to remove from the piece of a mold, it becomes unnecessary to give neutralization which time amount requires for the polymer which becomes the origin of a lens blank in a hydration process. When using deionized water, in the final process of a process, the physiological saline for a buffer is introduced into a final package, and, subsequently to under a package, a lens is sealed. this -- the inside of a package -- the final balance (setting in the semantics of neutralization, final hydration, and the last dimension of a lens) of a lens -- sterilization among a room temperature -- it is for being in process and making it attained.

[0006] Although U.S. Pat. No. 4,961,820 (finishing [this / transfer to these people]) is indicating the final package for contact lenses, this package is formed from the lamination of the foil heat sealed by a transparent polypropylene blister (blister) and this transparent.

[0007]

[Problem(s) to be Solved by the Invention] by the way, U.S. Pat. No. 5,080,839 -- and -- said -- the 5,094,609th A number Although the chamber which has planned to automate completely the whole hydration process and the shift to the last package, and is indicated by each another side above-mentioned patent, and a process make it possible to deal with a lens automatically in hydration In the equipment automated completely, in order to realize the sex from Takao of a lens, the old place is not known for the automated equipment suitable for preparing a lens for inspection and processing a lens with a high production rate.

[0008]

[Means for Solving the Problem] United States patent application 994,564th of the new expansion in inspection of the contact lens by the approach concerning each above-mentioned patent to these people Automatic lens inspection which was indicated in the number (name of invention : "the lens inspection approach and equipment") was produced. Furthermore, it is the United States patent application 258,556th which relates to these people from the hydration of the contact lens which carried out humidity, and the latest advance in automatic handling. The approach of carrying out the automatic handling of the lens by the robot into hydration in advance of inspection by automatic lens check system which is in a number (name of invention : "the automatic gear to which hydration of the soft contact lens is carried out, and an approach") was also born.

[0009] Then, the purpose of this invention is offering the automatic gear which deals with and prepares a contact lens for checking. Also let it be the purpose to deal with this invention further, in order to cover a contact lens over inspection and a package, and to offer the automatic gear (for a lens to be inspected the same with having stated previously and to be packed here) to prepare.

[0010] Furthermore, in order to make easy inspection of the lens in an automatic check means, it is also the purpose of this invention to move a lens between carriers with the vented deionized water. And it is also the purpose of this invention to offer the equipment from which the air bubbles generated on the surface of a lens are removed in advance of the inspection in automatic lens check system.

[0011] In addition, it is also the purpose of this invention to offer the inspection approach which suppresses formation of air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection, to the minimum and which the fabricated contact lens has improved by inspecting a lens in the vented deionized water.

[0012] Moreover, a lens is first fabricated in the disposable mold frame for contact

lenses, and it is also the purpose of this invention to inspect and to offer the manufacture approach which the soft contact lens which performs neutralization which hydration and the time amount of the lens which packed in the physiological saline and was formed by the polymerization in this final package require has improved in the vented deionized water. And it is also the purpose of this invention to add the integration system which removes a defective lens from Rhine of an inspected lens in advance of a package by the above-mentioned all directions method.
[0013] Another purpose of this invention is offering the method of inspecting a contact lens in the vented deionized water, and the method of removing deionized water automatically after inspection.
[0014] Finally, this invention also makes it the purpose to offer the equipment to which the station which blows away air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection was attached and which is made to move a contact lens to an inspection station from a hydration station.
[0015] This invention is mainly the United States patent application 258,654th. Although the contact lens fabricated between the 1st [which is in a number (name of invention : "a contact lens shaping system")], and 2nd pieces of a mold is described, that it is suitable also like integration of the engine-lathe processing lens cut and ground so that it may have a desired optical surface should understand the equipment concerning the shaping system of this invention, maintain a hydrogel to dryness. Furthermore, the equipment of this invention can be used also for the integration system of the lens formed by the spin cast method fabricated in the configuration of a desired lens optical surface, applying a liquefied monomer to a centrifugal force.
[0016]
[Embodiment of the Invention] The equipment which vents deionized water to the inspection / package concerning above-mentioned this invention, and the purpose and advantage of an approach will be easily understood by this contractor by detailed explanation about a desirable mode given with reference to the drawing of the following attachment. In addition, in the attached drawing, the same reference mark was given to the element common to each drawing.
[0017] This invention is a thing for the part concerning the processing after the hydration in a contact lens automatic manufacturing installation. United States patent application 258,654th It is fabricated with an automatic production line which is in a number (name of invention : "the system which deals with the contact lens in hydration"), and is the United States patent application 994,564th. The contact lens by which the automatic check was carried out as it was in a number (name of invention : "the lens inspection approach and equipment") has the large place which participates in the advantage of this invention.
[0018] (After [hydration] process) This invention proposes the multiple-purpose disposable lens package carrier which transports a contact lens during inspection and works as a part of last package after inspection.
[0019] the suitable package carrier 20 shown in drawing 1 is manufactured from injection molding or a sheet-plastic ingredient like the polypropylene by which heat formation was carried out, and it has the pair of the insertion flanges 33a and 33b (only 33a is shown in drawing 1) for making it align on the package carrier treated by the robot in the inclination wall 38 which makes the 1st flange material at the end, and the other end -- the rectangular plane base member 34 is included mostly. This package carrier is the United States patent application 995,607th of these people. It is indicated in detail by the number (name of invention : "the lens package for

ophthalmology"). The insertion notches 31a and 31b are formed in each ** of the base 34, and these notches have two incomes with a package carrier and the insertion pin in the various support pallets used in processing / package actuation which covers a lens over the further handling and processing. The opening 36 of almost a semi-sphere which is formed in a package at one and is in agreement with the curvilinear configuration of a contact lens (not shown) shifts from the core of a package, and is prepared. A contact lens is stored in this opening 36 in the state of seal, while being examined by the suitable sterilization water solution by the same approach as U.S. Pat. No. 4,691,820 (Martinez; finishing [transfer to these people]). Height h of the flange 38 prolonged from the base member 34 complements the depth of an opening 36, and in case it has two incomes with the flanges 33a and 33b in the pallet carrier of the special configuration mentioned later, it enables the self-array (self alignment) of a package carrier. It is used by the flange 38 again also in the case of the last package of a product, having two incomes with the upheaval 32 (in order to stuff carton for shipment after this, assistance which supports the opening structure of the package carrier set in **** repetition **** is carried out) of two or more "Chevron (**** of Yamagata)" configurations.

[0020] An opening 36 includes two or more marks 37 for collating again. While removing deionized water by one of the processing stations after hydration, this mark is used in case it assists holding a contact lens to the mid gear of an opening. A package carrier is equipped with the annular flange 39 used for heat sealing lamination covering of a foil again in order to maintain a contact lens at an airtight condition in the case of shipment. In order that a user may use a lens, in case the clipping section 35 removes the lamination of a covering stock or a foil, it is used for making grasping of a flange 38 and a package easy.

[0021] The base member 34 contains smooth flat-surface 34a which offers the engagement band suitable again for a vacuum gripper with the bottom. This flat-surface 34a is used for transporting a package carrier in each phase of a production line.

[0022] Drawing 2 shows the inspection carrier which transports a package carrier in a lens automatic check system. The inspection carrier 10 includes the 1st and 2nd trains 10a and 10b of the opening 40 which offers the path for storing the ball 36 of a package carrier and viewing a lens automatic check system. The engagement pin 41 prepared in each ** at equal intervals engages with a package carrier, and edge engagement pin 41a merely engages with the package of a piece. These engagement pins engage with the engagement notches 31a and 31b of a package carrier, and attain exact engagement on a package carrier in the longitudinal direction of an inspection carrier. It prevents that the another side hard edges 42a and 42b serve as a mark of agreement of the flanges 33a and 33b which prolonged and came out downward, and a carrier package rotates them with a pin 41. The hole 43 further for three engagement is established in each ** of the inspection pallet 10. In case these holes transport the inside of an automatic lens inspection station for a pallet or perform wearing and removal for a package carrier, when a pallet is fixed to a position, they are used. The pair of the slots 44a and 44b for grasping the overhead migration system which installs an inspection pallet in an inspection pallet in addition to this at automatic lens check system, and is removed after this is prepared. The pair of a slant face 45 gives a clearance for the flange 38 which prolonged and came out to the bottom in the package carrier 30 to enter.

[0023] As shown in drawing 1 , there are two purposes in the lens carrier 20 made from polypropylene. One is becoming a carrier at the time of inspecting a lens with

automatic lens check system, and another is becoming a container for a final package of the lens at the time of shipping to an end user. These package carriers are typically fabricated by the predetermined array by total of 4x4 trains [16] per 1 molding cycle, and are removed from the mold of injection molding by the robot migration means.
[0024] Subsequently to a pallet loading station, a package carrier is laid in the existing inspection pallet 10. In a desirable mode, a package carrier is fabricated in 4x4 arrays in order to make manufacture effectiveness in such an array max, but in case it moves to an inspection pallet, it is made into 2x8 arrays. Subsequently the inspection pallet 10 loaded with a package carrier is a conveyor, and is conveyed to the deionized water injection station 16 indicated to be drawing 10 to 11. Each package carrier conveyed with the inspection pallet 10 is this deionized water injection station 16, and is filled up with the deionized water vented to the part. The inspection pallet 10 is transported to lens loading area by push conveyor after this. In this lens loading area, batch processing is carried out by the 2nd pallet so that the contact loading area where a total of 32 package carriers with which it filled up with the deionized water by which gas drainage was carried out stand in a row may be given.
[0025] (Gas drainage of deionized water) This invention is the United States patent application 994,564th. The gas drainage finishing deionized water containing a surfactant little as an inspection medium for automatic lens check system in a number is used.
[0026] When using only deionized water for a package carrier ball, friction and a hydrophobic suction force may arise between a contact lens and a carrier front face, and the impression which bars moving a lens to a desired location may occur. For example, in a certain well-known process, a contact lens is formed from a liquefied HIDOROGE monomer, and as it is in U.S. Pat. No. 4,495,313, a polymerization is carried out under existence of a diluent with inactive sand-proof ester etc. This inactive diluent is filled up with the opening of the hydrogel lens between polymerizations, and, subsequently is exchanged for deionized water in a hydration process.
[0027] By the way, also after a hydration process is completed, since a small amount of acid radical may remain on the surface of the lens, when a lens is laid in the impression of a lens carrier, a lens may adhere to the ball front face of a carrier for these acid radicals. If it does so, since free migration will be checked, a lens may not move to a desired location. When such a situation happens and a lens is inspected with automatic lens check system, since a lens does not go into an inspection visual field, it may be refused, or may be accidentally judged as a defective.
[0028] United States patent application 258,266th In a number (name of invention : "the surfactant which locates the object of optical inspection in the center"), it has proposed adding a little surfactant to deionized water as a solution over this problem. It assists that a surfactant prevents that reduce friction between an impression and the front face used as a lens and a lens holder, and a hydrophobic suction force occurs, and a lens can draw near certainly to a desired location.
[0029] Various surfactants can be used for this invention. For example, it is known for the trade name of polysorbate (Polysorbate) 80 or tween 80, tween 80k0, etc. by polyoxyethylene 20 sorbitan monooleate. If tween 80 is added by the concentration of 25 section extent per solution 1 million section, although a lens can move in the inside of the package carrier 20, without adhering, it can be used also by concentration higher than this. For example, 0.01 - 5.0 % of the weight is sufficient as the concentration in a solution. Since a surfactant builds a desired solution, it is mixable with suitable liquid carriers (support), such as deionized water.

[0030] The concentration of the surfactant in a solution has the desirable minimum of the density range described in the top. For example, it may be lower than the 50 sections per deionized water 1 million section. If a surfactant is used by such low concentration, it will be avoided that a surfactant foams and a surfactant will be made as for it to below predetermined concentration.
[0031] In case it is made to blow off under a low-pressure (atmospheric pressure) environment from fluid Rhine which compressed water, in order to prevent that air bubbles or the bubble of gas generates, it is desirable to use the vented water. If the deionized water which is not vented is used, it is generated in a package, or in case small air bubbles move a contact lens to a package carrier before moving a lens, they will arise on a contact lens. It is generated from the gas which is dissolving in deionized water, and these air bubbles serve as a kind (seed) of a lens, or unevenness with a small package carrier front face.
[0032] The equipment which vents deionized water is shown in drawing 3 -5. Drawing 3 is the mimetic diagram of a gas drainage module, and another side drawing 4 is the detailed longitudinal direction sectional view of the gas drainage unit 122. Deionized water is supplied through an input line 112 from the source of deionized water (it also becomes a source of supply at the time of hydration). When leading water from a container, an air blanket is covered over a deionized water tank or a pump 114.
[0033] Deionized water lets a filter 118 pass in order to remove the particulate contaminant from the outside which has a possibility that it may be contained, subsequently to underwater.
[0034] Deionized water is supplied to the inlet port of the gas drainage unit 122 after this. In the gas drainage unit 122, deionized water branches in two or more tubes 124 arranged at the manifold, and joins again by the exhaust port 126 of the gas drainage unit 122. The gas drainage unit 122 drives a vacuum pump 128, and is operated under low voltage (typically 4 - 25torr). It connects with the gas drainage unit 122 through tubing 130, and this vacuum pump 128 discharges superfluous air from a gas drainage unit through tubing 132.
[0035] If deionized water comes from the gas drainage omission unit 122 outside through an exhaust pipe 126, it will flow into Manifolds 138a and 138b through Tubing 136a and 136b and the precision perfusion pump 140. A manifold is used in the impregnation station 16 and the robot shift array 102 attached in robot shift equipment as a common source of supply which provides each package carrier for contact lenses with two or more nozzles. In the pump 140 which sends out the vented deionized water to a manifold 138, it is a FMI pump (Fluid Metering of New York State Oyster Bay, product made from Inc.) Oyster Bay Pump Works of New York State Oyster Bay, and Inc. It attached and used for the pump driving gear of manufacture. Only an exact amount pours the solution of gas drainage finishing deionized water into a package ball, and these pumps suppress generating of air bubbles and adhesion of a lens, prevent that to which a solution overflows (water will adhere to the seal field of a package), and can control it to the amount of water suitable for check system.
[0036] If drawing 4 is seen here, the gas drainage unit 122 for monomers is shown in this drawing at the detail. This gas drainage unit 122 includes the pressure field which consists of the side attachment wall 144, the top plate 146, and the pars-basilaris-ossis-occipitalis plate 148 of a cylindrical shape. The hole 130 which stands in a row in a vacuum pump 128 is established in the business shown in the pars-basilaris-ossis-occipitalis plate 148 at drawing 5 .

[0037] The top plate 146 is attached in the side attachment wall 144 of a cylindrical shape using a flange 150 and O ring 152 (compressed between a flange and a top plate). Compression of O ring 152 and anchoring to the flange of the top plate 146 are performed using the bolt 156 which attaches the top plate 146 in a flange.
[0038] The inhalant canal 121 of water is prolonged through the top plate 146, branches in two or more tubing of desirable equal die length by the Y shape connector within chamber 144a, gives the equal back pressure, and realizes a uniform flow rate to each branching. These tubing is connected to the silicon manifold 160. Inside a gas drainage tank, 2-10 silicon manifolds (it has ten tubes which penetrate gas, respectively) are arranged. These six manifolds are used in the desirable mode of this invention. The manifold 160 connects in order what has arranged two in parallel.
[0039] The internal structure of a gas drainage unit is attached in the pair of the blocks 167 and 168 made from Dirline which support both the pipe of a manifold, and the gas transparency manifold 160. The block 167,168 made from Dirline of a gas drainage unit may be hung from the top-face flange 146 using a harness 282,284. And this top-face flange 146 hangs a top-face block and a harness 286,288, and these harnesses 286,288 hang a base block. The water with which passage flows from the 1st parallel array toward a top to the bottom returns to a crowning towards the 2nd array equipped with the tube 290. And next, it progresses to the following parallel array through a tube 292 from this 2nd array. Finally the water which carried out gas drainage progresses to the emission tubing 126 through the discharge pipe 244 toward a top outlet.
[0040] While piling up in the manifold made from silicon, the gas which dissolved is led through the outlet of a chamber 130 by the vacuum generated with the pump 126, and shifts from deionized water through the tube wall of a manifold 160. When water approaches the crowning of a chamber, the gas which dissolved is exhausted mostly.
[0041] One of the manifolds 160 is indicated to be drawing 12 to 13. Among these, drawing 12 is the partial diagrammatic view which the manifold 160 expanded, and drawing 18 is the 13-13' line sectional view of drawing 12 . As shown in drawing 13 , each manifold 10 contains two or more tubes 288 arranged by -four -three [three]. Each tube 288 is attached in the manifold anchoring blocks 294a and 294b which really which closes a manifold to the anchoring block 167,168 made from Dirline contain the closure member 296.
[0042] In order to raise the effectiveness of extensive migration, a static mixer 170 (the piece of them is shown in drawing 12) is installed in each tube of a manifold 160. These static mixers (Koflo of the Illinois carry shrine manufacture) are the products made from Dirline, a diameter is 1/4 inch and die length is 6 inches.
[0043] An ingredient desirable for a gas permeability tube is the STHT tube made from Sanitech of New Jersey Andover (it manufactures from the silicone rubber of Q74780 medical-use grade of the Dow Corning manufacture of Michigan Midland).
[0044] The equipment of this invention is arranged so that each manifold 160 may contain ten tubes. 1-/8 - 1/2 inches of 1-/16 - 1/32 inches of 1/4 inches and wall thickness of each tube is [a bore] 1/32 inch preferably, and a durometer degree of hardness is 80.
[0045] From silicon or other impermeable ingredients, it can have a header tube in the crowning and pars basilaris ossis occipitalis of a tank, and it can come. Each makes these tubes the same die length so that the differential pressure which becomes flow the origin which imbalance produces may not arise. Subsequently to one, each header tube is connected to a Y shape so that the outlet of gas drainage equipment may be carried out.

[0046] the stream which uses drawing 5 by this invention -- it is the mimetic diagram of a system. In this drawing, deionized water is supplied from the recycling supply pipe 202 through the pneumatic valve 210 of a latching valve 204, a filter 206, a flowmeter 208, and the electric actuation type that controls supply of deionized water electrically. A check valve 212 and the manual system latching valve 204 isolate in order to carry out recycling of the deionized water in a conduit 202. A supply pipe 214 supplies what carried out little measuring of a surfactant like tween 80 described previously.
[0047] Deionized water is compressed with the air blanket (air blanket) supplied from a distribution system through the conduit 218 which has the electric actuation type solenoid valve 224 which was stored in the maintenance tank 216 and equipped with the pressure regulator 220, the air filter 222, and the rapid exhaust port 226.
[0048] the normal operation of equipment -- setting -- the deionized water in a tank 216 -- 10-20psi -- desirable -- 15psi(s) It is compressed with the maintained blanket of pneumatic pressure. From the deionized water tank 216, deionized water is led to the 1st T character manifold 232 through a conduit 228 and a filter 230, and branches in the style of [two] a process here. One of these process styles is the United States patent application 256,556th described above. Water is supplied to the hydration equipment in a number (name of invention : "the automatic gear which hydrates a soft contact lens, and an approach").
[0049] the bypass system containing a bypass valve 234 and a branch pipe 236 -- a pair -- T characters connects with a system through a conduit 238. In normal operation, the closedown of the bypass valve 234 is carried out, deionized water passes along the T character manifold 238, a latching valve 240, and the inlet-port tube 121, and even the gas drainage tank 122 of this invention advances. the vented deionized water -- the time of supply -- the outlet from the gas drainage vacuum tank 122 -- it progresses to a lens transfer nozzle and an inspection package through a conduit 244 and a valve 246.
[0050] In order to take out a sample at the time of a request, the holes 248 and 250 for samples are formed. If the connector of the collar head in the inlet-port tube 242 and the outlet tube 244, an inlet valve 240 and an outlet valve 246, and a bypass valve 234 are used, a system will be bypassed through the shunt 236 which faces to the gas drainage vacuum tank 122, and continuation actuation of a production line will be maintained at the time of wastewater.
[0051] In the steamy recycling tubing 252, it is the United States patent application 432,927th. As it is in a number (finishing [transfer to name: "online steamy plumbing equipment" of invention, and these people]), in order to sterilize a distribution tube periodically, a latching valve 254, the pressure gage 256, and a filter 258 are formed. In the case of normal operation, steamy supply is performed by [as not becoming together with supply of the vented deionized water using the shut-off valve 260 of a lock type]. These two valves isolate distributive system and it is made for a steam not to go into a gas drainage vacuum tank and a deionized water tank. Moreover, a check valve 264 is also installed so that neither deionized water nor a steam may enter into a system during sterilization of distributive system.
[0052] The output of a gas drainage system branches through 1st T typeface manifold 266 and 2nd T typeface manifold 268, and three main systems concerning the gas drainage finishing deionized water of this invention are obtained. In order to measure the pressure of each main system, the pressure gages 270 and 272 are formed. The pair of the precision metering pumps 140a and 140b is sent out to the lens transfer nozzle used in case the lens which showed gas drainage finishing deionized water to

drawing 6 -9 is transported to the following system from a certain system. 3rd precision metering-pump 140c is sent out to the manifold 178 which showed gas drainage finishing deionized water to drawing 10 , and two or more nozzles 174. These nozzles measure gas drainage finishing deionized water correctly, and inject it into the pallet 10 with which two or more carriers 20 for an inspection package already explained in drawing 1 were settled.

[0053] The gas drainage vacuum tank 122 is equipped with the vacuum gage 280, the vacuum port 130, the pressure-sensitive switch 282, a vacuum pump 128, and the exhaust port 132 that discharges air and the pressed-out deionized water in a drain system. As already stated, the pressure of a tank 122 is usually maintained by 4 - 25torr using the vacuum pump 128 by which a switch change is carried out. When operating gas drainage equipment to usual, a small amount of deionized water penetrates the curve of the silicon tube 160, and is pressed out, and a vacuum pump 128 is a diaphragm pump which can deal with little water at the time of normal operation.

[0054] (Preparation before inspection) This invention is the United States patent application 258,556th. It suits, especially in case invention indicated by the number (finishing [transfer to name: "the automatic hydration equipment of a soft contact lens and an approach" of invention and these people]) carries out.

[0055] As shown in drawing 6 , the hydration carrier 860 which carried plurality, for example, 32 contact lenses, moves from hydration equipment to a migration location. Depending on each convex lens carrier, the lens of a piece is merely conveyed. Subsequently to drawing 6 and drawing 7 (A), the robot concrete supply system equipped with 4x8 arrays 102 (recombination is also possible) of a convex lens carrier which carries out connection rotation locates an array in the shown upper part of 2nd hydration carrier 860a.

[0056] As shown in drawing 7 (A), only one contact lens 8 is conveyed by the concave lens carrier 861, and is held immediately under the convex lens carrier 104 installed on 4x8 arrays 102. The concave lens carrier 861 includes at least one port 862 for introducing a fluid between the front face of a concave lens carrier, and a lens 8. A fluid is supplied through the channel 866 which cut off the upper part plate 867 bottom. This channel 866 connects a fluid manifold and two or more fluid connectors 863, and is prolonged to the surface upper part of the concave lens carrier 861 with which the fluid connector 863 is best shown in drawing 6 R> 6. The fluid connector 863 is made into a configuration which engages with the fluid coupling 864 formed in the 4x8 array 102 bottom. the object for fluids which supplies the fluid for migration used for these coupling transporting a contact lens 8 from the concave lens maintenance means 861 to the convex form lens maintenance means 104, respectively -- it connects with a conduit 874.

[0057] It is desirable that migration of a fluid twists a contact lens to pneumatic pressure in the mode which is transported to the robot array 102 from the hydration carrier 860 and which is shown in drawing 6 . therefore, the conduit 874 -- the compressed air is sent to coupling 864 and the coupling member 864 sends the compressed air to the fluid coupling 863, the channel path 866, and a port 862 delivery and shortly.

[0058] As shown in drawing 7 (A), after hydrating a contact lens 8 at a hydration station, it is still moist only with water having been dropped. Furthermore, in order to make easy to deal with it the contact lens which became wet by bringing near a lens in the center within the concave surface of the lens maintenance means 861, hydration of the lens is carried out by the deionized water containing a little surfactant. For this

reason, if air compression Rhine 874 is operated, extrusion with air takes place through a port 862, and a contact lens can be pulled up from the front face of a concave lens carrier to the upper part, and will engage with the convex form lens carrier 104. While the lens has adhered without a surfactant or this to the convex form lens carrier 104, a surfactant wets the front face of the convex form lens carrier 104, and increases the adhesion force to this front face with the surface tension of deionized water, and surrounding atmospheric pressure. In order to secure direct and exact migration in the case of migration, as for each convex form lens carrier 104, it is desirable that you make it located in a 1.5mm lens.

[0059] after transporting a lens 8 to the convex form lens carrier 104, a robot concrete supply system equips the manifold which has two or more cup members 104 (one of pieces of this was shown in drawing 7 (B)) which resembled the manifold 860 in the array of a lens -- "-- cellular ******** is carried out and it is made to move to" station Each cup member contains the concave surface 108 of the almost same configuration as the convex of the 2nd convex form lens carrier 104. Although the concave surface of this cup member understands that such a concave surface 108 is desirable, the same function is obtained also with single jet equipment. A concave surface 108 includes at least one port 110 for taking in a compression fluid through the central path formed in the cup member again. Although it will become easy to move a lens to the 2nd carrier from the 1st carrier if a little surfactant is included in deionized water, on the other hand, generating of the small air bubbles 105 is caused in the layer of wrap deionized water for a contact lens 8. If it puts to the compression fluid which spouts a lens, the small air bubbles 105 will shift and disappear outside, before transporting a lens to an inspection carrier. In order to prevent that the negative data mistaken by automatic lens check system are taken, it is desirable to remove such air bubbles. Deionized water can also be used although the compressed air was used in the desirable mode of this invention.

[0060] (Impregnation to a package carrier) As drawing 3 and 5 were explained, gas drainage of the deionized water is carried out in the gas drainage unit 122, and it is distributed to a deionized water impregnation station (it is indicated in 11 as drawing 10 in detail) by two or more precision perfusion pumps 140. As shown in drawing 11 , band-conveyor 12made of rubber a equipped with the pair of a belt conveys the inspection carrier 10 from the package carrier loading area 11 (shown in drawing 3) to the deionized water impregnation station 16. In order to stop a series of inspection carriers 10 to the upstream of the impregnation station 16, pneumatic pressure ****** 170 equipped with the click 171 is used. When loading with the new inspection carrier 10, the pneumatic pressure juice press style 170 draws a click 171, and the inspection carrier 10 is conveyed at the impregnation station on conveyor 12a. The group of the isolated jaw which was attached in another pneumatic pressure lock device engages with the inspection pallet 10 by the same approach, and holds this firmly in a package impregnation location. Two or more impregnation nozzles 174 are attached in the level round trip beam supporter material 176, and are connected to the FMI precision perfusion pump 140 through two or more tube members 178. Each pump is connected to each nozzle at this time. Termination of each nozzle 174 is carried out with the gage Teflon needle which is 16 pieces whose bores are 0.045-0.048 inches, and it is hung above the ball member 36 in more detail immediately on the package carrier 20. In the case of actuation, the pneumatic cylinder 180 firmly fixed to the support frames 181 and 182 makes the conveyance member 184, the perpendicular support 185,186, and the water Biratori attachment beam 176 go, and locates the tip of a Teflon needle caudad from the ball 36 with which the package

carrier 20 became depressed. The tip of a Teflon needle is turned caudad, and it goes and comes back to it, and it lets this needle pass, and since about 600ml gas drainage finishing deionized water is filled up with a ball 36 in part, it is poured in. It can pull up, in order that a pneumatic cylinder 180 may operate and the both-way supporting beam 176 may lift a Teflon needle from the package carrier 20, if predetermined deionized water is poured into a ball 36. In case gas drainage finishing deionized water is poured in, it becomes unnecessary to agitate, if the impregnation needle which reciprocates is used. If unsuitable churning is carried out, air will be incorporated and it will lead to generating (it becomes the origin of the mistaken negative inspection result) of air bubbles. Subsequently, the inspection carrier 10 comes out of the impregnation station 16, and goes to the edge of conveyor 12a. And it engages with the push conveyor which crosses the platform of stainless steel and pushes in the inspection carrier 10 to lens inspection loading area here.

[0061] Although 2x8 pieces and 4x8 arrays are used in the processing section after the hydration concerning this invention, it could be understood in this invention that the array of various arrays can be used.

[0062] 4x8 arrays of the hydration carrier 860 shown in drawing 6 differ from 4x8 arrays of the package carrier in the lens loading area formed of the pair of a pallet 10. 4x8 arrays to which 4x8 arrays 102 attached in the robot migration means 100 have the dimension of 30mm around between lenses in the hydration carrier 860 -- and -- "-- it can adjust so that cellular ******** may be carried out and the" station 70 may be stored, and if it does so, it will expand to the dimension of 30x50mm. This in the lens loading area (by the way, drawing 8 and 9 explain) formed of the pair of the inspection pallet 10 is equal to the dimension of the 3rd 4x8 array.

[0063] A pattern that contraction arrangement of this array was carried out again at drawing 9 in 4x8 arrays 102 by which expansion arrangement was carried out is shown in drawing 8 . An array 102 contains 32 convex type lens carriers 104 which explained drawing 6 and 7 previously. Along with the center line of an array, four fluid coupling members 864 which make a conduit 863 engage with the 2nd hydration carrier 860 are located in a line. An array consists of four Rhine 190-193 where each conveys eight convex form carriers 104. Nucleus Rhine 190-193 is installed so that drawing 8 may explain in detail, and it may go along with the internal guidance rods 194 and 195. The pneumatic pressure chucks 196 and 197 are formed in each ** of an array, and as shown in drawing 8 , they draw outside Rhine 190 and 193 which is in actuation and coincidence in the outermost part along with the guidance rod 194,195. The outermost arrays 190 and 193 are the pairs (a sign 198 shows one of pieces [them] to drawing 8 .) of internal slide ******, respectively. the role to which this pulls out innermost Rhine 191 and 192 outside -- carrying out -- it conveys. At this time, Rhine 190 pulls Rhine 191 and Rhine 193 pulls Rhine 192. Compression spring 199 assists dividing each Rhine of an array again.

[0064] It should also care about that it can rotate around a turntable 103 in order to give suitable bearing for an array, in case an array 102 transports a lens to lens loading area from a hydration station. Since a turntable 103 is attached in the 1st and 2nd connection arms, the perfect direction of three dimensions can be made to move among the various migration points which a robot concrete supply system gives to 4x8 arrays.

[0065] the interior which carries out termination of the convex form lens carrier 104 in at least one port 111 again as shown in drawing 7 (A) and drawing 7 (B) -- a conduit 110 is included. This port 111 uses a fluid for introducing into a convex form lens carrier and a contact lens 8 in between. Although arrays 190-193 spread so that it

may align with each convex form lens carrier 104 when the array 102 is located above two or more lens carriers 20 in lens loading area It is immediately under [it] the package carrier 20 related at this time. A little (usually 300microl) gas drainage finishing deionized water It is sent out through a conduit 110 by the precision perfusion pump 140, and even the ball 36 of the convex form carrier 104 to the package carrier 20 transports a contact lens 8. If gas drainage finishing deionized water is used also here, from the gas which the lens was dissolving into deionized water, small air bubbles cannot generate and be afraid (this may serve as a "seed" on a contact lens 8), and can move. If a lens 8 is transported to the package carrier 20, 4x8 arrays 102 will be crushed using a pneumatic chuck 196,197 (drawing 8), and they will be returned to a form so that the configuration of the hydration carrier 860 may be suited.

[0066] If lens loading area is loaded with the pair of the inspection carrier 10, the 2nd servo motor drive type push arm will transport both pallets from lens loading area even to an overhead double shaft conveyance carrier. This conveyance carrier takes out one of inspection carriers, and it picks it up in order to send to an automatic lens inspection station. About this, it is the United States patent application 258,557th. It has indicated in the detail at the number (name of invention : "the automatic gear for preparing a contact lens, and an approach").

[0067] As mentioned above, although this invention has been **(ed) and explained to a desirable mode, if it is this contractor, adding modification to the mode stated on these specifications in the range which does not deviate from the publication of a claim may recollect.

[0068] The concrete embodiment of this invention is as follows.

1) Said fluid supply means is robot equipment possessing the vacuum gas drainage equipment for supplying deionized water [still finishing / gas drainage] to said 2nd fluid means according to claim 1.

2) Said vacuum gas drainage equipment is robot equipment of the embodiment 1 above-mentioned publication equipped with a means to produce the differential pressure for passing deionized water through two or more gas permeability tubes which think deionized water to be a vacuum chamber to gas drainage, and this gas permeability tube.

3) Said vacuum gas drainage equipment is robot equipment of the embodiment 2 above-mentioned publication further equipped with the vacuum pump which maintains the vacuum level in the inside of said vacuum chamber to 4 - 25torr.

4) The process which vents said deionized water is an approach according to claim 2 performed in vacuum gas drainage equipment in advance of the process filled up with said a part of inspection carrier.

5) It is the approach of the embodiment 4 above-mentioned publication which said vacuum gas drainage equipment is equipped with two or more gas permeability tubes which were attached in a vacuum chamber and this chamber, and which are received for gas drainage processing of deionized water, and includes the process which produces differential pressure for said gas drainage process to send in deionized water through said gas permeability tube.

[0069] 6) Said vacuum gas drainage process is robot equipment of the embodiment 5 above-mentioned publication which includes further the process which maintains the vacuum level in the inside of said vacuum chamber to 4 - 25torr.

7) The process which maintains said differential pressure is robot equipment of the embodiment 6 above-mentioned publication attained by covering the deionized water storing tank which supplies deionized water to said gas drainage equipment with an

air blanket.
8) Said gas permeability tube is equipment according to claim 3 with which a durometer degree of hardness is formed from the silicone rubber of 80.
9) For 1 / 8 - 1/2 inch, and wall thickness, a bore is [said each gas permeability tube] equipment of the embodiment 8 above-mentioned publication it is [publication] 1 / 16 - 1/32.
10) The bore of each of said gas permeability tube is equipment of the embodiment 9 above-mentioned publication which is 1/4 inch.
[0070] 11) The wall thickness of each of said gas permeability tube is equipment of the embodiment 9 above-mentioned publication which is 1/32.
12) Said each gas permeability tube is equipment of the embodiment 9 above-mentioned publication bundled by two or more gas drainage manifold assemblies.
13) Said deionized water is equipment of the embodiment 12 above-mentioned publication which forms serial passage if each tube of said manifold is supplied and it is in said manifold, forming parallel passage.
14) Said equipment is equipment possessing the storing tank which contains further the deionized water which carries out gas drainage processing according to claim 3.
15) A means to make said differential pressure occur is equipment of the embodiment 14 above-mentioned publication which is the air blanket of ascendancy maintained in said storing tank.
[0071] 16) Said manifold is equipment possessing two or more nozzles attached above two or more contact lens packages according to claim 3.
17) Said manifold is equipment of the embodiment 16 above-mentioned publication which reciprocates perpendicularly in case deionized water [finishing / said gas drainage] is distributed to said contact lens package.
18) It is equipment of the embodiment 17 above-mentioned publication which can be perpendicularly pulled up from said package if said nozzle enters perpendicularly at said contact lens package, and the flow of said deionized water measured precisely ends while the tip of each of said nozzle is immersed in said distributed gas drainage finishing deionized water, and the flow of said deionized water ceases as for the tip of said nozzle.
19) It is equipment according to claim 3 which two or more contact lens carriers are contained in said two or more distribution points, and divides the lens anchoring side of a convex form in which each of this carrier stores a contact lens, and the path of the fluid which introduces said vented deionized water between the contact lens anchoring side of said convex type, and the field of a convex form.
[0072]
[Effect of the Invention] As explained above, according to this invention, the automatic gear which deals with and prepares a contact lens for inspection / package is offered. Moreover, according to this invention, between carriers, a lens can be moved and inspection of the lens in an automatic check means can also be made easy with the vented deionized water. And in advance of the inspection in automatic lens check system, the equipment from which the air bubbles generated on the surface of a lens are removed is also offered. In addition, the inspection approach which suppresses formation of air bubbles with a possibility of giving the negative data which were mistaken on the occasion of automatic lens inspection, to the minimum and which the fabricated contact lens has improved is also offered by inspecting a lens in the vented deionized water. According to this invention, the last is provided also with the equipment to which the station which blows away air bubbles with a possibility of giving the negative data which were mistaken on the occasion of

automatic lens inspection was attached and which is made to move a contact lens to an inspection station from a hydration station.

CLAIMS

[Claim(s)]
[Claim 1] It is robot equipment which moves two or more soft contact lenses to the 2nd processing station from the 1st processing station. (a) It is the 1st frame which arranged two or more 1st contact lens carriers. Said carrier holds a concave lens maintenance side and the contact lens to transport, respectively. Said concave lens maintenance side This maintenance side and the 1st frame which divides the 1st fluid means which introduces a fluid between lenses, (b) It is the robot migration head which makes it easy to transport said lens to the 2nd processing station from said 1st processing station. (i) The lens anchoring side of convex [to be two or more contact lens carriers, and for each carrier store a contact lens] type, The contact lens carrier which divides the 2nd fluid means for introducing a fluid between this lens anchoring side and said contact lens front face, (ii) A connection robot migration head equipped with the robot migration means which moves said migration head to the 2nd processing station from said 1st processing station, (c) The 2nd frame which carried two or more 3rd contact lens carriers which receive the contact lens by which a fluid supply means to supply the vented deionized water to said 2nd fluid means, and (d) migration are carried out, (e) Robot equipment possessing the controller which operates said robot migration means and the 1st fluid supply means, and transports said lens to said 2nd carrier from said 1st carrier.
[Claim 2] The process which is the approach of inspecting and packing the fabricated contact lens with an automatic production line, and vents (a) deionized water, (b) The process which fills up a part of package carrier with the deionized water containing a little surface active agent which the above vented, (c) The process which removes said deionized water automatically from said package carrier after inspection, and subsequently fills up said package carrier with the physiological saline for a buffer in part, (d) Approach including the process which seals them on said package carrier in order to provide a user with said lens and the physiological saline for a buffer.
[Claim 3] It is equipment which vents deionized water in case a contact lens is inspected and packed. (a) vacuum chamber, (b) Two or more gas permeability tubes which are attached in the interior of said vacuum chamber, and accept continuously the deionized water which carries out gas drainage processing, (c) A means to make the differential pressure for sending said deionized water through said two or more gas permeability tubes occur, (d) Equipment equipped with at least one precision metering pump which measures the manifold which distributes said vented deionized water to two or more distribution points, and an amount with less deionized water which carried out (e) degassing than 1ml, and is sent out to said each distribution point.